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PROCEEDINGS

OF THE

SEVENTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics.

(Formerly National School of Dental Technics.)

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FOR THE YEAR 1899, PHILADELPHIA.

FOURTH VOLUME, PUBLISHED 1900.

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THE S. S. WHITE DENTAL MFG. CO.

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PREFATORY NOTICE.

In presenting this report of the proceedings of the seventh annual meeting, the Publication Committee has taken the liberty of reporting only an abstract of the discussion had. In doing so care has been exercised that each speaker's ideas, and, so far as seemed wise, his language has been retained. The effort has been to eliminate everything redundant or irrelevant, and it is hoped that all interested may feel that the committee has done all that was possible to put on record a fair statement of the proceedings, and with no intention to restrict or misinterpret any one.

Thomas E. Weeks,
Hart J. Goslee,
Nelville S. Hoff.

PROGRAM

of the seventh annual meeting of the Institute of Dental Pedagogics (formerly National School of Dental Technics), Philadelphia, Pa., December 27, 28, and 29, 1899.

WEDNESDAY, 27th.

10.00 A.M.—Preliminary organization, payment of dues, report of executive officers, executive business.

10.30 A.M.—Report of Committees on Syllabi. "Operative Technic," Dr. T. E. Weeks; "Prosthetic Technic," Dr. H. J. Goslee.

11.30 A.M.—President's address, Dr. N. S. Hoff. Discussion, Drs. E. C. Kirk and H. A. Smith.

2.00 P.M.—"Syllabus for Dental Curriculum," Dr. F. D. Weisse. Discussion, Drs. S. H. Guilford, M. W. Foster, and G. V. I. Brown.

3.30 P.M.—"Dental Pedagogics," Dr. A. E. Webster. Discussion, Drs. C. N. Johnson, R. H. Hofheinz, and L. G. Noel.

7.30 P.M.—Address, "Manual Training," Prof. J. Liberty Tadd.

8.30 P.M.—"The Use of the Lantern in Teaching," Dr. M. H. Cryer.

THURSDAY, 28th.

10.00 A.M.—"Orthodontia Technic," Dr. C. S. Case. Discussion, Drs. C. D. Lukins, Grant Molyneaux, and B. Holly Smith.

11.30 A.M.—"Root Preparation Technic," Dr. H. J. Goslee. Discussion, Drs. I. N. Broomell, H. W. Morgan, and H. P. Carlton.

2.00 P.M.—"The Use of the Blackboard in Technic," Dr. A. D. Gritman. Discussion, Drs. C. J. Essig and H. W. Arthur.

3.30 P.M.—"Operatory Methods," Dr. W. H. Whitslar. Discussion, Drs. W. E. Wilmott and D. M. Cattell.

5.00 P.M.—Election of officers.

FRIDAY, 29th.

10.00 A.M.—"The Use of Text-Books in Class Work," Dr. Otto Arnold. Discussion, Drs. G. E. Hunt and H. B. Tileston.

11.00 A.M.—Symposium of fifteen-minute papers on our text-books: "Operative Dentistry," Dr. G. V. Black; "Prosthetic Dentistry," Dr. I. N. Broomell; "Dental Pathology," Dr. A. H. Thompson; "Dental Therapeutics," Dr. J. Truman; "Oral Surgery," Dr. T. W. Brophy.

1.00 P.M.—Adjournment.

MINUTES.

Continental Hotel, Philadelphia, December 27, 1899.

The seventh annual meeting convened at 10.30 a.m., with the president, Dr. N. S. Hoff, in the chair.

Twenty-three colleges were represented by delegates, and about sixty were in attendance.

On motion, the minutes of the sixth annual meeting were approved as printed in the proceedings.

A verbal report of the Executive Board was made by the chairman, Dr. G. H. Wilson, announcing the work of the board and submitting the program. Upon motion, the report was accepted and approved.

Moved that a vote of thanks be extended to the Local Committee of Arrangements for aid in preparing program and arranging for meeting. Carried.

The chair announced that the program had been slightly altered in order to give Committees on Operative and Prosthetic Technics more time to report, and that the president's address would be the next order of business.

Vice-President H. P. Carlton was called to the chair, and the president delivered his address.

Discussion was opened by Dr. E. C. Kirk, and continued by Drs. Smith, Barrett, George Hunt, Weeks, and Brophy, then closed by the essayist.

Dr. Kirk then presented an invitation to hold the evening session at the University of Pennsylvania, on account of better facilities for lantern exhibits, and announced that luncheon would be served there preceding the session.

Moved and carried that the same be accepted.

Report of the Committee on Operative Technic Syllabus then presented by Dr. Weeks, followed by the report of the Committee on Prosthetic Technic Syllabus by Dr. Goslee.

Upon motion, both were approved and accepted.

Dr. Guilford then made the report of the Local Committee of Arrangements.

Motion to accept and approve carried.

Dr. Guilford then extended an invitation to the body to attend a theater party on Thursday evening, and to visit the Philadelphia Dental College some time during the day.

Upon motion, both invitations were accepted, and the latter was made a special order of business for 12.30 o'clock Thursday.

Adjourned.

2.30 P.M.

Meeting called to order by President Hoff.

Minutes of the previous session read and approved.

Moved by Dr. George Hunt that a committee of three be appointed to consider the president's address with a view to acting upon the suggestions made therein. Carried.

Chair appointed Hunt, Weeks, and Webster as a committee.

The following resolution was then offered by Dr. Hunt:

WHEREAS, Our time is limited and straight talking to the point has ever been characteristic of this body; and

WHEREAS, Dispatch is necessary for the transaction of our business; therefore,

Be it resolved, That no one shall occupy the floor more than once to speak on any subject until all who desire to speak have finished, and then only with the consent of the body; and be it further

Resolved, That no one shall occupy the floor in the discussion of any subject for more than five minutes, except he ask for and receive the unanimous consent of the house, in which case he may then occupy another five minutes only; and be it further

Resolved, That the chair is requested to time each speaker and vigorously enforce this rule. (Signed) GEORGE E. HUNT.

Resolution received and referred to Executive Board.

Report of Executive Board indorsing Dr. Hunt's resolution received, and upon motion approved.

In the absence of Dr. Weisse, who was unable to arrive in time, Dr. Webster read a paper on "Dental Pedagogics." Discussion was opened by Dr. C. N. Johnson and continued by Drs. Thompson, Smith, and Darby, and then closed by the essayist.

Dr. A. J. Gritman then read his paper on "The Use of the Blackboard in Technics."

In the absence of Dr. Essig, the discussion was opened by Dr. H. W. Arthur and continued by Drs. Hoff, Tenney, Whitslar, Barrett, Wilson, Truman, Case, and Guilford, and then closed by the essayist.

At the request of the chair, Dr. Brophy then addressed the meeting on the advisability of the colleges representing this body making some effort toward an exhibit of charts and technic work of American dental colleges at the Paris Exposition.

Moved by Dr. Taft that the matter be left in the hands of a committee appointed by the chair. Discussed and carried.

The chair then named Brophy, Wilson, Morgan, and Hunt as a committee, with instructions to report later.

The secretary then announced an attendance of seventy-five, representing twenty-three colleges, of which seventeen had qualified.

Adjourned.

6.30 P.M.

Luncheon was served at the University of Pennsylvania, after which Professor J. Liberty Tadd addressed the meeting on the subject of "Manual Training," and Dr. M. H. Cryer on the "Use of the Lantern."

Adjourned.

THURSDAY, DECEMBER 28, 10.30 A.M.

Meeting called to order by the president.

Minutes of previous session were read and approved.

Application of Washington Dental College, of Washington, D. C., presented by Dr. W. W. Evans, read by the secretary, and referred to the Executive Board.

Dr. C. S. Case then read his paper on "Orthodontia Technics."

In the absence of those on the program, Dr. H. A. Smith was called upon to open the discussion, but declined.

General discussion then followed, participated in by Drs. Weeks, Wilson, Templeton, Guilford, Whitslar, Hoff, Goslee, Carlton, and Grant, then closed by the essayist.

Moved to include paper on the subject presented by Dr. Goddard in the proceedings. Supported and carried.

Dr. I. N. Broomell then extended an invitation to visit the Pennsylvania College of Dental Surgery, which was upon motion accepted, and made a special order of business for 9.30 o'clock Friday morning.

Adjourned.

2.30 P.M.

Meeting called to order, with the president in the chair.

Minutes of previous session read and approved.

Dr. H. J. Goslee then read his paper on "Principles and Technique of Root Preparation." Discussion was opened by Dr. H. W. Morgan, and continued by Drs. Carlton, Broomell, Guilford, and Essig, then closed by the essayist.

Dr. F. D. Weisse then read a paper on "Syllabus for Dental Curriculum." Discussion was opened by Dr. Guilford, and continued by Drs. Taft and Thomson, and closed by the essayist.

The committee appointed to consider the president's address then made the following report:

To the President and Members of the National School of Dental Technics:

GENTLEMEN,—Your committee appointed to consider the president's address desires to make the following recommendations concerning the matter contained therein:

1. We recommend that the name of this organization be changed to the Institute of Dental Pedagogics.

2. We further recommend the appointment of a committee to consider the unification of the curriculum, said committee to collect such data as they may deem necessary for the purpose of making a report and a recommendation at our next annual meeting.

3. In regard to holding the annual meetings at points where colleges of exceptional facilities and equipment exist, we believe that while such points have some advantages, as suggested by the president, our meeting places should not be selected with that sole object in view. Some of the smaller schools might well be stimulated to an increase in apparatus and facilities by the prospect of a visit from this body. Geographical conditions will also enter into the matter. We approve of the recommendation regarding visiting the schools in the city in which we meet.

Respectfully submitted,

(Signed) GEORGE E. HUNT,
THOMAS E. WEEKS,
A. E. WEBSTER.

Motion to accept the report was then carried.

Motion made by Dr. Stellwagen to substitute the word "stomatological" for "dental," so that the name of the organization would be Institute of Stomatological Pedagogics, was not supported.

Moved, then, that the report be adopted. Supported and carried.

Dr. W. H. Whitslar then read his paper on "Operatory Methods." Discussion was opened by Dr. W. E. Willmott; continued by Drs. Cattell and Foster, and closed by the essayist.

The next regular order of business was the election of officers, which resulted as follows:

President, Dr. H. P. Carlton, of San Francisco, Cal.; vice-president, Dr. George E. Hunt, of Indianapolis, Ind.; secretary-treasurer, Dr. H. J. Goslee, of Chicago, Ill.; member of Executive Board, Dr. W. Earl Willmott, of Toronto, Canada, for three years, to succeed Dr. George H. Wilson, term expired.

The Executive Board now stands: Dr. Henry W. Morgan, chairman, one year; Dr. D. M. Cattell, two years; Dr. W. Earl Willmott, three years.

Adjourned.

FRIDAY, DECEMBER 29, 11 A.M.

Meeting called to order, with President Hoff in the chair.

Minutes of the previous session read and approved.

Committee appointed to consider the advisability of making, in the name of the association, an exhibit at the Paris Exposition, then presented the following report:

To the President and Members of the National School of Dental Technics:

GENTLEMEN,—Your committee appointed to report on the advisability of making an exhibit at the Paris Exposition beg leave to submit the following: In our opinion an exhibit should be made, and we herewith recommend the following method: The exhibit shall not include methods of teaching, but shall include the finished product of the student. An adequate exhibit shall be selected by a committee appointed for that purpose from among the articles offered by the various schools. No credit in any way, shape or form shall be given to any individual school contributing to such an exhibit, as it is to be strictly an exhibit of the work done by the dental students of America.

We further recommend that an album or book be exhibited containing the photographs of such schools, members of this association, as desire to be represented, together with building plans and other items of interest.

We further recommend that a chart or syllabus be made giving the various branches taught by and in the schools of this body, and the average amount of time spent in or devoted to each branch. This chart should be as comprehensive as is consistent with such an article, but should not go into minute details regarding the various branches or methods employed. It should also include the entrance requirements.

In carrying out the above, we recommend the appointment of a committee with power to act.

Respectfully submitted,

(Signed) TRUMAN W. BROPHY,
GEORGE H. WILSON,
HENRY W. MORGAN,
GEORGE E. HUNT.

Motion to the effect that the report be accepted and adopted then made and carried.

Moved by Dr. Guilford that the sum of fifty dollars be appropriated for use of meeting room in hotel.

Moved to amend by appropriating thirty dollars. Amendment supported and carried. The motion as amended then prevailed.

Report of Executive Board concerning the application for membership of the Washington Dental College, to the effect that they were ineligible until becoming a member of the National Association of Dental Faculties, then presented and approved.

Dr. Otto Arnold then read a paper on "The Use of Text-Books in Class Work." The chair announced that as this paper was intended as a preface to the symposium to follow, the discussion would be postponed until the reading of such papers, and then be general. This announcement was received and approved.

The following papers on text-books were then read:

"Prosthetic Dentistry," Dr. I. N. Broomell.

"Dental Pathology," Dr. A. H. Thompson.

"Oral Surgery," Dr. Truman W. Brophy.

"Dental Therapeutics," Dr. James Truman.

In the absence of the latter, his paper was read by the secretary.

The discussion was then opened by Dr. George E. Hunt, and continued in lively manner by Drs. Barrett, Smith, Webster, Wilson, Grant, Morgan, Taft, and Weisse; then closed by the essayists, Drs. Arnold, Thompson, and Brophy, finishing what proved to be one of the most interesting sessions of the entire meeting.

A committee was then appointed to escort the newly elected officers to their chairs, and they were then duly installed, each replying with words of appreciation.

The new president, Dr. Carlton, then appointed Drs. Brophy, Whitslar, and Goslee as a committee of three to arrange for the making of an exhibit at the Paris Exposition, as provided for in the resolution adopted.

Moved and supported that a vote of thanks be extended to the Local Committee of Arrangements, to the college faculties for the courtesies extended, and to the hotel management, each motion prevailing unanimously.

A motion was then made to continue the Committees on Operative and Prosthetic Technics, which was supported and carried unanimously.

There being no further business, the meeting adjourned.

NOTE.—List of membership colleges with duly accredited representatives present, dues paid and entitled to vote:

College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Royal College of Dental Surgeons.
Dental Department of Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
Dental Department, University of California.
Indiana Dental College.
Dental Department, University of Buffalo.
Dental Department, University of Pennsylvania.
Baltimore College of Dental Surgery.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery.
Dental Department, Ohio Medical University.
Pittsburg Dental College.
New York College of Dentistry.

By Proxy.

Northwestern University Dental School.
Dental Department, University of Omaha.

Membership Colleges without Accredited Delegates.

Dental Department, University of Iowa.
Birmingham Dental College.
Western Dental College.
Dental Department, Columbian University.
Kansas City Dental College.
Dental Department, University of Tennessee.
Department of Dentistry, Southern Medical College.
Atlanta Dental College.
Cincinnati College of Dental Surgery.
Dental Department, Detroit College of Medicine.

Dental Department, Marion Sims College of Medicine.
Dental Department, Milwaukee Medical College.
Missouri Dental College.

Total membership	33
Colleges represented by delegates	20
Colleges without delegates	13
Applications received	1

Respectfully submitted,
(Signed) H. J. GOSLEE, *Secretary-Treasurer.*

PRESIDENT'S ADDRESS.

By N. S. HOFF, D.D.S.

Gentlemen of the National School of Dental Technics: Following the precedent of my predecessor in office, and at the invitation of your Program Committee, I beg your indulgence while I try in a brief way to direct your attention to some particular functions of this organization, which, it seems to me, should be carefully considered at this meeting or in the very near future, in order that we may successfully meet the demands made upon us and the expectations and hopes of our enthusiastic supporters.

It seems to me that the one demanding our first consideration is that to which my predecessor so ably directed your attention one year ago, and upon which you did not at that time feel prepared to act. I refer to the advisability of changing the name of the organization so that it would include the larger conceptions we now have of our work. I do this not because I am not satisfied with the presentation made by my predecessor, but because I believe we are now more in accord with the idea and better prepared to consider it. When the present name for this organization was adopted it was suggested by gentlemen who were full of enthusiasm, because they had found a systematic and satisfactory method of presenting the subject of operative dentistry from the purely technical standpoint to their classes. And, believing others would be interested in the same system and would be helpful in its future development, they conceived the idea of organizing a class or school of instruction.

Prosthetic technics was added later, and the name, National School of Dental Technics, seemed to be not only appropriate, but entirely adequate. But as time passed, and the value of the several meetings held began to appear in the great advance made, and because of the stimulus started by the discussions had and the exhibition of actual results obtained in work accomplished by the students, teachers in other subjects of the dental curriculum became interested, and asked that their work might also be recognized and admitted for consideration; until at this time there is a persistent demand that the scope of our organization be enlarged, and possibly its name changed so as to admit at least all the specially correlate subjects of a practical or technical character, if not the entire dental curriculum. This subject was considered of so much importance last year that your president's address at the last meeting called especial attention to it, and suggested it as a very proper subject for consideration.

The idea has met with some opposition, largely from those who fear that the past usefulness of the organization in developing and maintaining interest in the purely technical subjects may be impaired or obscured by long discussions of a purely pedagogical nature on subjects which, while important as fundamentals, are generally taught by science teachers having no particular knowledge of dental technics.

This objection, it seems to us, has no considerable justification, because of the fact that none of these subjects have ever been considered or offered for discussion in our meetings; neither have the teachers in these departments manifested any considerable interest in our meetings. It is very possible that we should be largely advantaged by having such teachers—many of whom are specially educated for their occupations, and devote their entire lives to teaching—discuss their particular problems in our meetings. And we might well afford to give them the time necessary to gain that which shall enable us not only to impart technical knowledge, but to instill correct intellectual habits with our instruction. In the excellent address of Professor C. M. Wright at our meeting one year ago he made this statement, which is well worth considering in this connection, "Every one who has been placed in the position of a teacher has thought much about methods, but definite notions are rare." Is it not true that the large majority of our technic teachers have taken up the work without any special preparation, and hold their positions as a result of mere accident?

Does it necessarily follow that because a man has made a success in the practice of his profession, he is therefore qualified to administer the affairs of an institution organized to educate professional men? Or because a man can make a beautiful and artistic filling that he is the man to instruct others in the same art? Is it not too true that many of our teaching faculties are organized on these standards?

And men are put into positions as teachers or leaders of thought and action who, while abundantly able to execute and probably to think satisfactorily for their own necessities, yet come far short of measuring up to their opportunities from a pedagogical standpoint. As Dr. Wright suggests, such teachers must think much as to methods and try many costly experiments, and only arrive at definite notions after long experience. Would it not therefore be of the greatest value to us, mostly teachers by accident, to have the benefit of the counsel and experience of those who, because of their education and experience, ought to be qualified to be helpful in broadening our outlook and giving us a larger conception of our duty?

I am not pleading for less of the purely technical, nor for the pedagogical exclusively, but, for reasons implied if not expressed, I fear we shall not be able to sustain the present interest nor accomplish our purpose unless we are willing to take a broader view of the subject. I feel confident that we should take a conservative action in declaring at once our purpose and desire to discuss fully not only the purely technical subjects of our curriculum, but also such as have an indirect relation to what are called the "practical chairs." Fortunately we are to test this idea, to some extent at least, in the present session. Your Executive Committee has given us this year a program which I am sure will develop this thought more vividly than I can hope to do in calling your attention to it here briefly.

If we are to admit other subjects than the technic of operative and prosthetic dentistry, we should, to some extent at least, define the object of the association, so that in the future the limits of our field may not be questioned. Some still believe that the place for pedagogical discussions should be in the meetings of the National Association of Dental Faculties, and claim that this organization must always be looked upon as a section of that body and subject to its decisions in all questions involving changes in methods of imparting instruction; others express the hope that the time will soon come when the National Association of Dental Faculties will take up the work now done by this organization with more effectiveness, because it will be able to command obedience to any conclusions reached, while this organization has no power to enforce its edicts.

We are of the opinion, and many others we know hold the same, that from all present indications there is no hope that the National Association of Dental Faculties will very soon, if ever, be in a position to calmly and thoroughly take up the subject of methods of teaching with the hope of any definite results. The time of the National Association of Dental Faculties is fully taken up with executive affairs of very little interest to teachers from the pedagogical standpoint, but of great value in a general educational way to our profession. And the sessions of that organization are so frequently the scenes of so great mental agitation as to render impracticable an unprejudiced discussion of anything so tame as a method of imparting instruction. Is there any one who was present at the recent meeting of the National Association of Dental Faculties who would be so rash as to venture the opinion that a pedagogical subject could have received adequate treatment in that meeting?

We are fully convinced by the interest manifested in the last two meetings of this organization that it has a mission, and is filling a place heretofore unoccupied in the work of dental education. And while many things of pedagogical interest must be given over to the National Association of Dental Faculties for final sanction, such as preliminary requirements, length of course, subjects taught, when taught, etc., the actual teaching work and the best ways of doing it must come through some distinctively organized body, such as the present National School of Dental Technics. This organization has not power to enforce its edicts; it should not in any case make laws, neither does it. It may influence legislation by educating its members or by creating a sentiment which shall result in wise legislation, but its time should never be taken up with legislation or with the discussion of purely legislative topics. We may increase the standard for entrance by demonstrating the necessity; we may lengthen the college course by showing the need.

We may likewise secure a scientifically graded or uniform course of study by discussing the time and place in our curriculum where a student will pursue certain studies to the best advantage. If we are to accomplish so much it must be apparent to every one that we cannot narrow our scheme to the two practical branches only, and in their technical aspects. We must, in fact we are bound to, take in the whole curriculum, and every subject contained in it should be a proper one to bring before this body.

If we are then to broaden our scope of work, it seems that it will be highly proper and necessary to change the name of our organization so that it will express the objects we have in view. At the previous meeting the name "School of Technology" was suggested in place of "School of Technics," which is certainly more in harmony with our present ideas. We would further suggest, as we are not a national organization,—having at least one member from another country,—that we substitute "American" in place of "national." And since we do not meet in the capacity of a school, which term pertains largely to the primary departments of education, while we all profess to be masters, and especially since we do not, in any usual acceptation of the term, conduct a school with a master and pupils, but our proceedings are more in the nature of a convention, that the term "institute" would more accurately define our organization; and since we meet to discuss or consider the science that treats of the facts and principles of our art, the term "technology" is amply expressive.

Therefore we suggest that the name of our organization be changed to that of the "American Institute (or Convention) of Dental Technologists." Such a name would be comprehensive and dignified. It sufficiently localizes the organization, and defines its purpose in terms that can be appreciated the world over. It permits of unlimited expansion, and yet is distinctively inclusive. An experience of three years in providing programs for discussions by this organization justifies me in urging that you take up this matter at this meeting and settle definitely the policy and sphere of action for this organization, so far as may be done constitutionally.

My predecessor in office last year suggested this change as a possibility, and I most earnestly recommend it as a necessity at this time, if we are to obtain the greatest usefulness from the organization and continue the wonderful interest of the last two meetings and the promising success of the present one.

Another matter which it seems to me demands early consideration is the curriculum of study in our dental schools. I am fully aware of the fact that I am broaching a subject for endless discussion possibly, and one which may belong to another organization. My conviction, however, is that no organization is so well calculated to adjust this problem satisfactorily as this one, for the reason that it will never be satisfactorily adjusted except on purely pedagogical principles and practices. It should be discussed entirely from that viewpoint. If our profession has any justification in its classification as an art or science, it must be built upon principles. If so, what are they, and how shall we best illustrate them to such as may be seeking knowledge of them? Is it necessary that a dentist should know more than the anatomy of the teeth or their immediate environment, or more physiology than will enable him to artificially supply dental organs lost accidentally or by disease, or more chemistry than will enable him to bleach a stained tooth? Is it possible that we are spending entirely too much time studying anatomy, physiology, chemistry, bacteriology, general pathology and surgery, at the expense of the more important technical details? Do we devote so much of our time to the study of purely medical sciences as to seriously interfere with the development of such technical skill as is demanded by our art in the practice of our profession?

I shall not attempt to discuss these questions here, or at least now, but I bring them before you because I believe they are not only pertinent subjects at this time, but that they are fundamental, and should be considered before we proceed to consider the best methods of presenting them to our classes. Let us determine if we can whether we need them at all, and, if so, to what extent. Then we shall be ready to give them their proportionate time and place in the curriculum, and be prepared to forever silence the teacher who assumes to say that the dental student does not need this or that; also the indolent student who is forever wanting to know of what use this or that particular study will be to him when he gets into the practice of his profession.

There is here a large field for discussion and plenty of room for difference of opinion, and it may seem like a problem of too many unknown quantities to give us any hope for satisfactory solution. It seems to me, however, that it is a matter of the greatest importance, and we cannot escape its consideration if we dare hope to put our educational system on a uniform and scientific basis.

It is a large and formidable problem, but none too large or formidable for the wisdom, courage, and fraternal spirit which has and does characterize the membership of this body. And I commend it for such early consideration at the hands of our Program Committee as may seem expedient.

Another matter which it seems to me would add interest to the proceedings of this body is that our meetings should be held in such places as are located schools having unusual opportunities in the way of teachers of recognized abilities, buildings well planned and equipped for imparting instruction, or other advantages which might be utilized by the less favored schools. And that a systematic visitation and inspection of not only the buildings and equipment be made a special order of the program, but that such schools be put on the program, and that their methods of management and of imparting instruction be as fully demonstrated as is practicable.

This has not been done before by this body because it was thought that the meeting should be held entirely distinct from any college, to avoid any unpleasant jealousies which are apt to manifest themselves where there are two or more schools located in the same city. It may be that such a course was advisable when this organization was younger and contained representatives from only a few of the schools, but since it has become strong enough to take care of itself, and contains most of the schools in its membership, it does seem as though it had earned the right to be independent and take some risk for the sake of benefiting its constituents as much as possible.

As an illustration, it was thought by some of the members of the Executive Board that it would be very desirable to set apart some of the time allotted to this meeting for visiting the schools in this city; this being one of the oldest and best-known educational centers in the United States, and containing three of the oldest and most creditable schools, each having an excellent building and equipment, and the members of their faculties are well known and thought of the world over.

Could we not well afford the time necessary to make a reasonable inspection of the facilities at least which these institutions possess, and also an idea how they are utilized? There are many things in connection with the school in which I teach that I am always glad to show any one interested in teaching this line of work, and I know that every other teacher has the same feeling and experience.

I am very sure there are some particulars in which each of the schools of this city are doing better and more thorough work than is being done by the rest of us, and it would be well if we could see their facilities and learn of their methods. At least it would give us a chance to compare notes, and would be the means of generating a spirit of emulation which could not be otherwise than helpful in results.

In conclusion, allow me to commend to you for your thoughtful consideration these items to which I have directed your attention, believing that in each lie possibilities for still further advancing the usefulness of this organization, and through it the elevation to a higher plane of our system of dental education.

DISCUSSION.

Dr. Kirk, opening the discussion. Mr. Chairman and members of the association: The address to which we have just listened is so thoroughly in accord with my own views upon the subject that it is quite difficult to discuss it. Certainly there has been little said that is open for criticism. The suggestion that the association change its name to harmonize more definitely with its avowed purpose is one which should meet with cordial and sympathetic approval and reception.

As I take it, we are not here for the purpose of studying new methods of performing technical operations in operative and prosthetic dentistry alone, but we are here avowedly for the purpose of studying better methods of teaching technical operations to students. The fundamental idea of the association is a pedagogical one. We are here that we may better educate ourselves as teachers and as demonstrators. At the beginning we confined ourselves to one or two branches of the curriculum. It seems to me we should extend beyond that idea, that we should study teaching methods in all the branches of the curriculum. There is a necessity for this expansion. What dentistry needs to-day more than anything else is properly trained and educated teachers. It is quite true, and I think there can be no difference of opinion as to the point raised by the president,—viz, that the simple ability to do technical operations or to perform any of the requirements of our calling does not in itself constitute a man a teacher. A teacher is something else. He must have the ability to convey the idea and understanding, the skill and power to perform these operations, to another individual. I am in hearty accord with the idea that we should extend the study of teaching methods to all subjects in the dental curriculum.

With regard to the proposed change of name, I am not able to see that the suggestion which our president makes as to calling us technologists differs essentially or etymologically from our present designation. If we are merely studying technics we are technologists. I would include what I deem to be the fundamental idea of the association—namely, the pedagogical idea—in its designation. That we are here as pedagogues of dentistry, which includes teaching as an art as well as a science in the elements of our profession. That is a matter which it seems to me is so important that it should be referred to a committee to take into consideration and report at this meeting.

I would raise a question as to the word "practical" in designating the faculty chairs. That has been one of the stumbling-blocks in the way of preparing a satisfactory curriculum, and if in using the word practical it is indicated that we are teaching some subjects that are not practical, I must take exception to it. I do not know that the president meant to imply that, but if there is anything that is more practical than a knowledge of anatomy, physiology, bacteriology, chemistry, and so on, I should like to know about it. It seems to me they are the most practical things we have to deal with. Certainly no practitioner who meets properly the demands of his patients will deny that a proper knowledge of these fundamental branches is essential, and therefore most valuable. Besides having the ability to go into a laboratory and make a tooth, there is the other scientific side of knowing the principles involved in doing it. We should not create confusion by calling one side of it practical and the other, by implication, impractical and theoretical. Even theory is a practical thing; one of the most practical things we can deal with. For a common example, when certain atmospheric conditions are present, when it is cloudy and the atmosphere is loaded with moisture, we have a theory that it will rain, and we practically make use of that theory in taking an umbrella as a protection, and so I think the word "theory" should not be used in such a confusing sense.

With regard to the National Association of Dental Faculties, it seems to me practically impossible, as the president has said, for the National Association of Dental Faculties to fully deal with these pedagogical questions. Its time is taken up with questions of administration and legislative questions, which exclude the broad consideration of these subjects; but, as a matter of fact, the membership of this association is largely the same as that of the National Association of Dental Faculties, so that what we do here could be legitimized by them if thought desirable. If we express an opinion and come to an agreement affecting the matter of a curriculum it could be legitimized by the National Association of Dental Faculties, for, consisting largely of the same membership, the two bodies would work harmoniously. It is important that this society should concern itself largely with the study of teaching methods, and leave the legitimizing or legalizing of the result to the body which is constituted for that purpose.

With regard to the subject of uniformity of curriculum, I would call attention to the fact that we may overdo the unification idea. It would be perfectly possible to unify the curriculum so that the work in each school should be the exact counterpart of the other, but it is illogical to attempt to create a body of dental practitioners as the product of such an educational system in the same way that the government creates soldiers, a lot of men cast in the same mold, all of the same type, and who work as automatons. There must be the element of individuality in all of the dental schools. There is a process of natural selection going on by which I think these minor differences in the curricula will largely adjust themselves. I do not wish to be understood as taking exception to the idea of a reasonable degree of unification, but let us not go so far as to crush out the individuality of the separate schools or the practitioners who are their product.

The next idea to which my attention was drawn was the question of the overbalancing of the dental curriculum on the one side as against the other. There may be a possible tendency to give too much time and study to the theoretical side of anatomy, pathology, and so on, to the disadvantage of the technic of the work. I think we are at present facing a very serious danger in that regard. I believe the solution of that difficulty should be found not in reducing in any degree the amount of time or attention that is given to this so-called theoretical or scientific side, but by an increase in the length of time devoted to the whole curriculum. I think any man who looks at this subject from an unprejudiced point of view will admit that there is no study either in the technical or theoretical side that we can dispense with. It seems to me that if dentistry is to occupy the position it should rightly assume and achieve the dignities we claim for it, we must take a position on a level with the other specialties of the healing art. I don't think we can afford to curtail any one of the branches. We must look this fact fairly and squarely in the face; that it does take and will take at least four years to properly equip a man for the intelligent practice of dentistry. It is true, as it is true of other medical and scientific specialties, that four years is none too ample for the work.

With regard to the final suggestion, that of the association visiting schools, the idea is an intensely practical one, and one which bears directly upon our work here. It is an education in itself. I came into this room and saw one exhibit, the first exhibit that was installed here, and I felt I was fully repaid for any effort I might have taken to come here. In following the suggestion of the president that we visit these institutions, we ought to be able to pick up ideas that would be of very great use to us.

Dr. H. A. Smith. I can only recommend the paper as being very able, and as covering the whole ground fully. I feel as though I can say very little after the able discussion of our friend Dr. Kirk. If you will observe the trend of the address, you will notice that it is following in line with the suggestions made by the president last year. Dr. Hoff, our president, in the exuberance of his youth has gone a little further, and reiterates certain changes which Professor Black suggested. I made a few remarks in reference to the suggestions of Dr. Black last year, and I know no reason for changing what I thought proper for the society to adopt at that time. I claimed then that to extend the scope of this organization would be a usurpation of the purposes of the Faculties Association, and I still think so.

I sat by Dr. Hoff at that meeting on one or two occasions, and I noticed that his eyebrows were drawn down, and that he was pretty thoroughly disgusted with some of the things done. After that meeting adjourned we thought or reasoned this way about it: If we can change the methods of the Faculties Association so that the time will not all be consumed in useless wrangling, that there was the proper place to discuss methods of teaching and curriculum, and all that, but after a little lapse of time I have come to the conclusion that perhaps we had better keep within the definite lines of the purposes of this organization for a while, and give that body a chance to rise to its proper height. It is possible for that body to consume all of its time in questions of administration. There are certain burning questions before the dental profession to-day, and how long it will take to settle them I don't know; but so long as these questions are so prominently before the profession, it must necessarily consume very largely the attention of the Faculties Association. I think in time it will get away from all that, and when it does it will be the proper body to discuss the curriculum and methods of teaching. It is a representative organization, and can enforce its laws. This is more of a convention organized for a specific purpose: to cultivate and develop the so-called practical subjects in dentistry and dental technic. It seems we have not found enough in these subjects to occupy our attention. Although we have been in existence only three years, there is a cooling in the interest manifested in the exhibits, for instance. I come here, as Dr. Kirk has said, and see one exhibit, and may be compensated, but there is not enough in this alone to interest a body like this year in and year out for a quarter of a century, and we are reaching out for something that will interest us, and in doing that we are infringing the prerogatives of another organization; and, rather than take action, I would advise a further discussion and consideration of the whole question. Dr. Black was doubtful last year whether it was practical at that time; Dr. Hoff says now is the accepted time. I think it would be well to let the Executive Committee take the liberty of bringing in such questions as it chooses for the next two years, and keep on in our old way. This body is young; it must make a record in some way, and that is along the lines for which it was organized.

So far as the question of curriculum is concerned, I don't see that it concerns this body very much, but I need not go into that. If we do it is merely in the way of suggestion, for we have no power to enforce our ideas; the Faculties Association is the proper body to do that. I don't know that I have anything further to offer in that direction, as Dr. Kirk has quite thoroughly covered all the points.

Dr. W. C. Barrett, of Buffalo. I am in sympathy with the main part of the remarks of Dr. Smith. You can't make a part better and bigger than the whole. We must have some unity; some central thought; some central power; some single standard around which we can rally for the purpose of making a profession. Two rival heads in teaching, two rival associations, provided there is rivalry, will always work at a disadvantage. I have always been in favor of, and at one time introduced a resolution in the National Association, which was referred to a committee which never considered it, that the National Association should hold semi-annual meetings, and have possibly a division of that into sections, and make all teachers eligible to membership, and let them consider technical as well as methods of oral and didactic instruction, and that the annual meetings be solely devoted to business. That would make a complete organization. We must not lose sight of the fact that an organization or association which is to be a rival of another must result in confusion, and seriously interfere. The future is what we must look to, and not simply the present.

As for the matter of unification, I don't think that is practical at all, and trying to secure a uniform curriculum for all the colleges seems to me to be futile. I can readily see the advantage that might result in it from the exchange of students from one school to another. If they all have the same instruction, a student can go from one to the other without repeating the instruction and without losing something that might be essential to him. But I do not think this should be encouraged. Our school has a complete graded course, no two classes ever coming together, everything being graduated from beginning to end. Others have no graded course, but go from one subject to another until they are through, without particular system. But to force all into the same rut would be an arbitrary application of force which I should not favor. I believe we are doing pretty well as it is. I believe the most advisable thing is a semi-annual meeting of the National Association of Dental Faculties; and in due process of time institute sections in that body so as to permit the discussion of all educational matters. of whatever kind; then the annual session can be devoted to business, which is as essential as methods of teaching students.

Dr. G. E. Hunt. If my memory serves me right, this matter when it was brought up last year was discussed by Drs. Smith and Barrett in much the same language as this morning, and Dr. Kirk and myself said about what he has already said and what I expect to say, and probably the reading of last year's minutes would save all this. I am, however, surprised to hear Dr. Barrett say that there are schools in the Faculties Association that have not a strictly graded course. I was totally unaware of that.

Dr. BARRETT. You are not posted.

Dr. HUNT. That may be, but I am surprised to hear it. As far as this body attempting to pass any laws in regard to the unification of the curriculum or on any other subject which affects colleges we all know, I think, that that is an utter impossibility. We cannot do it. We have power to make suggestions, which would probably be received with more or less favor by the men who do shape the laws which govern these colleges. In fact, there are a good many of us here to-day that are representatives of these same colleges at the Faculties Association, and it is natural to suppose that anything we agree upon here we would be able to agree upon there. I know we cannot pass laws which will control the Faculties Association, but we can pass resolutions and give opinions which will be received with a great deal of weight by that organization. The Faculties Association should do these things, but it is not doing them, and I don't think ever will; and, since that is the case, why can't we save time and trouble by coming to conclusions ourselves? I think this is pre-eminently the body which should consider these matters, and if we don't consider them now they will never be considered in the future.

In regard to unification of the courses, I agree with Dr. Barrett that a complete unification of the course cannot be accomplished at this time. But I think a partial unification can be accomplished, and that it would be a most excellent thing for all of the colleges. I don't think the methods of teaching any particular subject can be followed by every other school and get the best results, but I do believe that the amount of time spent on most, if not all, subjects can be settled by this body. For instance, some schools teach chemistry three years; some only two years. Some teach anatomy only one year; some two, and, for all I know, three years. These things can be adjusted. If two years is sufficient to teach anatomy in the University of Pennsylvania, it is enough to teach anatomy in the Indiana Dental College. If two years are necessary for chemistry in one school, it is necessary in another. Of course, we cannot define methods of teaching for each school, but we can define the length of time to be spent on them. If we could unify the courses so as to define the minimum amount of time to be spent on the various studies, we would accomplish much. We have students coming from other schools, and it is very seldom that they do not go to the office and ask to be excused because they have completed a certain subject in another school. I have no doubt others here have had the same experience. That could all be done away with by unification to that extent only; that is, define the years in which certain branches shall be taught and nothing more.

Dr. JAMES TRUMAN. I was not at the meeting last year, and have not been present, with one exception, since the organization of this body, for the reason that I was always in the hope, since I assisted in the organization of the Association of Faculties, that that body would take up the various subjects that this one has taken up particularly. But after fifteen years' experience in the Association of Faculties, hoping against hope, I have come to the conclusion that that body never will do anything more than legislate on the various matters connected with our profession. It seems to me that that body of men have bottled up during the year all their antagonisms and hard feelings and they come to that association to ventilate them, and the result has been, as it was at the Niagara meeting, continual fighting, if I may use the term, almost from the beginning to the end. Now, to some of us this is disgusting, and for one I am tired of it, and I believe that the value of the Association of Faculties, whatever value it may have had in the past, is about completed. I am therefore here to-day to take part in this association perhaps more prominently than I have heretofore, because I believe that this work is to advance and, as stated by our president, this body in the future will take an altogether different stand from what it has in the past. I am wholly in accord with the views expressed.

So far as the views concerning the unification of the curriculum, I don't think that is possible, but we can reach out toward that point, and I think we should do so. When we come to consider education, not only in our branch but in other branches in general scholastic training, there is a lack of unity throughout this whole country. It is altogether different from what it is on the Continent, where there is unification in all the schools. Take, for instance, Germany, where a young man can go from one school to another and start in one where he left off in the other. If we could reach that position here it certainly would be a great gain not only for general education, but in our own professional education. This body must do the work that the Association of Faculties has failed to accomplish. This was work we supposed that body would accomplish, but it has not done so. Who is in fault I do not know, perhaps I as much as the others. We have so much to do in talking and wrangling over legislative matters that we have entirely forgotten the primary object for which that association was formed. I think the original position of this association was crude, because it confined itself to prosthetic and operative principles. You have your exhibits here, and they do good work, but they are not the principal things. We want to know how to teach. As Dr. Kirk has said, we want to make teachers. We haven't got them in our profession. It is one of the most difficult things, I presume, that every dean has to contend with, to secure men who can teach in the different branches. Many men can do the work, but very few can teach; and such is the object, as I understand it, of this body, to so instruct men that they may become teachers.

Dr. T. E. Weeks. I believe I am called upon to speak as one of the organizers of the National School of Technic.

It may be well to emphasize the thought that was in the minds of those who organized this association. There was but one thought, and that was based on the fact that the Faculties Association never had taken up subjects of an educational nature, and, as has been said, a number of the organizers were, or had been, representatives of their colleges in the Faculties Association, and had come to the same conclusion that the preceding speakers have expressed, that they never would. This school was organized primarily as an association of technic teachers, men who were trying to present in their respective colleges a systematic course upon such branches as could be taught to advantage by the laboratory method. But it very soon became evident from the interest manifested, not by technic teachers, but by teachers of every branch not represented by the laboratory method, that the scope of this organization must grow. And by its own force and impetus it will grow; we cannot help it.

I am particularly pleased, as one of the original organizers, to welcome the new proselyte, Dr. Truman. Such men as Dr. Truman being with us, and others who looked upon us in somewhat the same light as he did, is an assurance of the continuous growth and success of this organization. The one point I wish to emphasize is that our good friends who have spoken in the interest of the Faculties Association have nothing whatever to fear from this association. It was never intended as, and it never will become, the rival of the Faculties Association. From the nature of the constitution and purposes it never can be a rival to that association, and it never will aspire to be. I cannot entirely sympathize with Dr. Truman's impression in regard to the Faculties Association. I certainly do not wish to attend the obsequies of that association, but I hope it will swear off in a few things and lead a better life. In regard to our own association, I don't believe that any member of the association has ever voiced a sentiment or expressed a wish or desire to legislate in any way. That is not the object. It is to present methods of teaching and to discuss them, that every teacher who attends will be benefited and will carry something away from the meeting which will enable him to improve his course. While absolute unification never can result, still there may be a certain amount of unification which will be beneficial to all schools; that will be an inevitable result of our deliberations.

So far as the extension of the principles of this body, it is already extended, and we don't have to pass any resolution to extend it; it will extend itself. I think Dr. Barrett's suggestion is very good, but will it ever come? That matter rests with the Faculties Association, and not with us. It rests with the Faculties Association to extend an invitation to this body to unite along these lines, and when it comes it will be time enough to consider whether we will accept it.

Dr. W. C. Barrett. There seems to be a misunderstanding as to what the National Association of Dental Faculties' function really is. The most important work ever done was done at the meeting last summer. It was only done through a struggle. It could not be done in any other way. The schools and teachers, who alone know what the curriculum should be, can establish that curriculum, free from the dictation of those who are not acquainted at all with teaching. It is simply the establishment of a principle. The victory was complete; it is established, and it could not have been done in any other way. I thank God for the fight we had last summer.

Dr. T. W. Brophy. The president's address, which was an admirable one, called attention to a criticism as to whether it would be expedient to continue teaching anatomy as it is now taught, according to the rules of the Association of Faculties, or in some other way; and the same with regard to physiology and chemistry. I am sorry that that was in the address, because it might lead some to think there were members in this body in doubt as to the advantages that students will acquire by the study of physiology, anatomy, chemistry, bacteriology, and other scientific subjects that are now taught in our dental colleges. It is essential that the young men should be taught these subjects. It is not possible for a man to comprehend a part of the body and understand its physiology and its pathology, and so on, without having a knowledge of the entire structure. If the dental profession ever comes to the conclusion that it is not necessary to teach these branches, it will be a retrograde step.

As to the usefulness of this body and its relation to the Association of Dental Faculties, I do not share with the unfortunate views of Dr. Truman in regard to the National Association of Faculties. The dental profession is on a very much higher plane to-day on account of the work of that great body, and if it had accomplished nothing else than the work done last summer through a long contention, it would have won a victory in the interests of the dental profession that would stand to the end of time.

This association is but a midget compared with what it will be. It is just in the beginning of its usefulness. It started for the sole purpose of teaching technics of operative dentistry; later it added prosthetic dentistry, and to-day it has a field of work before it that was apparently not dreamed of, and that is everything that pertains to the whole dental curriculum. The advance made in the field of physiology in the last ten years is something surprising to men who have not looked into it. Pathology, bacteriology, and so on, all these branches must come up, and by and by we will see them presented by the teachers who have charge of them, and the work of this body will expand in a better form than ever before, and you will find it one of the greatest educational bodies in this country. The National Association of Faculties cannot do this work. It is not its function. It is a purely legislative body. It has a great work to do, and it must be done. Look at the number of schools, and I am told there are about twelve new schools in this country that want to come in. That will take time. Those who have been in the Executive Committee know what it means to get together three days before the meeting in order that the matter may be put in shape for presentation to the association. It is true there are disturbing elements now and then, but we hope it will be better by and by.

I don't suppose Dr. Weeks and the other organizers ever dreamed this association would reach such proportions as we have now. It was through Drs. Weeks and Cattell that we branched out as a School of Dental Technic. I don't like the name, Mr. President, and I thank you for the suggestion to change it; change it to something which will indicate what its function is, and then let it grow as it will grow. We can't stop the progress of this association any more than we can change the course of Niagara. We will have a curriculum and lay out a course of study, and change the curriculum so as to include educational advancement, and after a while we will have four years of work instead of three. I remember when the National Association was started, in some schools then the term was but four months; and it has been changed to a minimum course of three years of seven months; and soon we are going to have four years of seven months, or possibly eight months. This has all been done by the work of the National Association. And that body is going to go on and do the work before it, and if we have to fight, we will fight to accomplish our ends, and we will win every time.

Dr. Hoff. I do not know what I can add to what has already been so ably said, and better than I can state it. This convinces me of the fact that our session is too short. We ought to have had a day instead of an hour to discuss the subject, because I know there are many here who are ready to speak on the subject more at length. I feel that I could take half an hour myself to amplify what I only suggested.

I think we are all agreed so far as enlarging the scope of the association, and the change of name is immaterial. The point made in the address was that we should change our name so as to give the Executive Committee power to incorporate in its program for our consideration any subject it saw fit to place on the program. Now, we have simply usurped that function, and do it because we want to. We don't do it with authority.

As to the suggestion that this is to be a rival to the Faculties Association, none of us who have at heart the work of this association will for a moment consider that. We are not its rival. We are its helper; we are its right hand. That is what we organized for, and that is what we intend to be. It has been said that we must have the National Association; that it has an important function, but I am also strongly convinced of the fact that this body has a function. As was often stated last year, we are to decide what we are to teach, and then we can hope to devise a method of teaching it.

I purposely restated this that it might be in your minds, to be considered whether or not it might be well to take up that particular subject and discuss it thoroughly at this time, or arrange for its consideration in the near future. I don't think that any one here understands that I am in favor of a reduction of the amount of anatomy or chemistry, or any of the other subjects that we teach. I am in favor most heartily of enlarging the scope, but we are met every now and then with the question as to whether dentists ought to know all about anatomy and physiology, and so on. In our own school I have had the greatest difficulty in convincing the teacher of anatomy that the dentist needs to know much more than the anatomy of the mouth. And I have had difficulty in convincing our physiologist, who is a scientific man, and not a dentist, that our students need to know more of his subject than that which concerns the nutrition of the body. The most important thing we have in physiology, perhaps, is the nervous system. He claimed we didn't need it; insisted we didn't need it. And so it goes all the way through. What I think we should do, if possible, is to define our course; not that we shall be mandatory, but define it with the idea of establishing an *ideal* course of instruction for dental students; not that we shall make anything mandatory in one or any of our schools, but it shall be one which is, according to the consensus of opinion of this body, ideal, and then we shall have something to start from. If any school or teacher should desire to change that ideal or make another course, it would be perfectly right and proper for it to do so.

If the National Association of Dental Faculties passes a law that schools shall teach a certain amount of anatomy, there will be more or less modification necessary for the various schools, because of their peculiar environment. I do not think it would be possible or even desirable for the National Association to make any such legislation. It can, in general terms, indicate what shall be taught and when it shall be taught, but some liberty or allowance must be granted to every school. If I were the governing body of the Faculties Association I would abolish every law it has enacted, and I would enact in place of them a code of ethics, and the school that lived up to it would enjoy the privilege of living up to it instead of obeying laws. I think we would not have as much wrangling as now. We want to raise the standard of general education and invite men to accept that as an ideal standard, and if they wish to modify it that is their privilege. We do not want to legislate at all.

OPERATIVE TECHNICS.

By T. E. WEEKS, D.D.S., Chairman of Committee.

Dr. T. E. Weeks, Chairman. It was deemed best to present this in printed form, it being largely tabular and diagrammatic, and so would be very voluminous if presented in any other way.

(Copies of the report were placed in the hands of each member before the doctor proceeded to read.)

Last year your committee reported a brief syllabus comprising the technic of Dental Anatomy and operative procedure. At your request the committee will present an elaboration of the chart presented.

Chart.

1. Nomenclature.
2. Dental anatomy: (a) Study of external tooth forms; carving in natural sizes and form. (b) Macroscopic anatomy; cutting and describing longitudinal and transverse sections of natural teeth.
3. Instrument nomenclature; making models of instruments.
4. Cavity preparation and instrumentation: (a) Manipulation, grasps, rests, direction and control of force. (b) Sharpening instruments. (c) Forming cavities by measurement. (d) Preparing classified cavities with their instrumentation.
5. Cleansing and filling of root canals.
6. Filling materials; their preparation and manipulation.

These divisions comprise the subjects recognized as the ones which can be taught to advantage in the technic laboratory. No suggestion will be made as to the place in the curriculum which the work should occupy, nor is it expected that the syllabus will be adopted in its entirety by any school,—rather the effort is to give suggestions which will be helpful to all. These suggestions are the composite of several successful courses. The matter is presented as far as possible in diagrammatic or tabular form.

The first topic comprises the nomenclature of the teeth; of instruments and instrumentation, and of cavities. The first division will be given as the beginning or basis of Dental Anatomy technic; the other two come in their proper connection.

Nomenclature.

In describing the teeth the following nouns and adjectives are used:

NOUNS.

Surface,
Plane,
Margin,
Angle,
Ridge,
Groove,
Sulcus,
Fossa,
Cusp,
Tubercle,
Root,
Canal,
Thirds,
Pit,
Fissure,
Embrasure.
Horn.

ADJECTIVES.

Incisal,
Occlusal,
Axial,
Mesial,
Distal,
Labial,
Buccal,
Lingual,
Gingival,
Proximal or Proximate,
Marginal.

NOTE.—There are of course many other words which appear in the text-books, but these are the principal ones which form combinations under certain definite rules.

- SURFACE.
  - AXIAL SURFACES.
    - Labial or Buccal,
    - Mesial,
    - Distal,
    - Lingual,
  - Occlusal,
  - Incisal (edge).

- MARGINS.
  - Labial or Buccal, Lingual Surfaces.
    - Mesial,
    - Distal,
    - Incisal or Occlusal,
    - Gingival.
  - Mesial or Distal Surfaces.
    - Labial or Buccal,
    - Lingual,
    - Occlusal,
    - Gingival.
  - Occlusal Surfaces.
    - Mesial,
    - Distal,
    - Buccal,
    - Lingual.

NOTE.—Marginal ridges take similar adjectives.

RULE.—Margins and marginal ridges of any surface take the names of the surfaces which they approach.

- ANGLES.
  - LINE ANGLES.
    - INCISORS AND CUSPIDS.
      - AXIAL LINE ANGLES.
        - Mesio-labial,
        - Disto-labial,
        - Mesio-lingual,
        - Disto-lingual,
    - BICUSPIDS AND MOLARS.
      - AXIAL LINE ANGLES.
        - Mesio-buccal,
        - Disto-buccal,
        - Mesio-lingual,
        - Disto-lingual,
      - Mesio-occlusal,
      - Disto-occlusal,
      - Bucco-occlusal,
      - Linguo-occlusal.
  - POINT ANGLES.
    - INCISORS AND CUSPIDS.
      - Mesio-incisal,
      - Disto-incisal,
    - BICUSPIDS AND MOLARS.
      - Mesio-bucco-occlusal,
      - Disto-bucco-occlusal,
      - Mesio-linguo-occlusal,
      - Disto-linguo-occlusal.

Line angles are formed by the junction of two surfaces along a line meeting at an angle.

Point angles (corners) are formed by the junction of the angles of three surfaces at a point.

Rule.—Both line and point angles take the names of the surfaces which form them.

- Ridges.
  - Incisors and Cuspids.
    - Labial Surface.
      - Labial (cuspids).
    - Lingual Surface.
      - Lingual,
      - Marginal,
      - Linguo-gingival.
  - Bicuspids.
    - Buccal Surface.
      - Buccal.
    - Occlusal Surface.
      - Marginal,
      - Triangular,
      - Buccal,
      - Lingual.
  - Molars.
    - Buccal Surface.
      - Buccal ridge.
    - Occlusal Surface.
      - Marginal,
      - Oblique,
      - Triangular,
      - Mesio-buccal (triangular),
      - Disto-buccal "
      - Mesio-lingual "
      - Disto-lingual "
- Grooves.
  - Incisors and Cuspids.
    - Labial,
    - Lingual,
    - Linguo-gingival.
  - Bicuspids.
    - Buccal Surfaces.
      - Buccal
        - Mesial,
        - Distal.
    - Occlusal Surfaces.
      - Central,
      - Triangular
        - Mesial.
        - Distal.
      - Mesial,
      - Distal.
  - Molars.
    - Buccal Surfaces.
      - Buccal,
      - Disto-buccal,
    - Lingual Surfaces.
      - Lingual.
    - Occlusal Surfaces.
      - Mesial,
      - Distal,
      - Lingual,
      - Buccal,
      - Disto-lingual,
      - Mesio-lingual (upper molar).
      - Mesio-buccal,
      - Disto-buccal (lower molar).
- Lobes.
  - Incisors, Cuspids and Bicuspids.
    - Mesial,
    - Middle,
    - Distal,
    - Lingual,
  - Molars.
    - Mesio-buccal,
    - Disto-buccal,
    - Mesio-lingual,
    - Disto-lingual,
    - Distal (lower first molar),
    - Fifth (upper first molar).

Note.—In bicuspids and molars the cusps bear the same names as the lobes.

Roots or Canals.
- Upper Bicuspids.
  - Buccal.
  - Lingual.
- Upper Molars.
  - Mesio-buccal.
  - Disto-buccal.
  - Lingual.
- Lower Molars.
  - Mesial
    - Buccal.
    - Lingual.
    - (canals).
  - Distal.

Horns. (of the pulp)
- Incisors.
  - Mesial.
  - Distal.
- Bicuspids.
  - Buccal.
  - Lingual.
- Molars.
  - Mesio-buccal.
  - Disto-buccal.
  - Mesio-lingual.
  - Disto-lingual.

Division into Thirds.

All surfaces of teeth may, for better description, be divided into thirds—both longitudinally and transversely—in two directions.

Thirds.
- Transverse. (Axial Surfaces.)
  - Incisal or Occlusal,
  - Middle,
  - Gingival.
- Axial. (Axial Surfaces.)
  - Labio-lingually.
    - Labial or buccal,
    - Middle,
    - Lingual,
  - Mesio-distally.
    - Mesial,
    - Middle,
    - Distal.
- Occlusal Surfaces.
  - Mesio-Distally.
    - Mesial,
    - Middle,
    - Distal.
  - Bucco-Lingually.
    - Buccal,
    - Middle,
    - Lingual.
- Roots.
  - Gingival,
  - Middle,
  - Apical.

Pits.
- Incisors and Cuspids.
  - Lingual surface.
    - Lingual.
- Bicuspids.
  - Occlusal surfaces.
    - Mesial,
    - Distal.
- Molars.
  - Buccal surfaces.
    - Buccal.
  - Lingual surfaces.
    - Lingual.
  - Occlusal surfaces.
    - Central,
    - Distal.

FISSURES.	INCISORS.	Lingual surface	Linguo-gingival (upper lateral).
	BICUSPIDS AND MOLARS.	Nearly all the grooves may show fissures, which bear the names of the grooves in which they appear.	

EMBRASURE—of the interproximal space: "That portion of the interproximate space that widens toward the buccal or labial or toward the lingual."—Black.

DENTAL ANATOMY.

In teaching external tooth forms there are certain points to be emphasized.

1. Arrangement in the arch.
2. Notation and formulæ.
3. General form.
4. Crown, root and gingival line.
5. The surface of the crown.
6. Division into thirds.
7. Angles of the crown and of the surfaces.
8. Margins of surfaces.
9. Ridges on surfaces and marginal ridges.
10. Fossæ, where found.
11. Sulci, names and location.
12. Grooves, of axial and occlusal surfaces.
13. Fissures and pits; location and cause.
14. Developmental lobes; number and position.
15. Interproximal spaces; size and form.
16. Measurement; compare Black's measurements with those of teeth coming under observation.

Illustration.

UPPER CENTRAL INCISORS (*Notation*[1]).

1. General form: Each incisor tooth has four surfaces and an incisal or cutting edge. It is divided into crown and root, the gingival line marking the division. An incisor tooth may be represented by a wedge and a pyramid united at their bases, the wedge standing for the crown and the pyramid for the root (see diagram.—P. 67, report for 1898).

2. Angles: There are four axial line angles; viz.—mesio-labial, mesio-lingual, disto-labial, and disto-lingual; and two point angles, mesio-incisal and disto-incisal.

3. Labial surface (la.); describe margins, angles, and planes.

4. Lingual surface (li.). The same. Note difference from labial.

5. Mesial surface (m.). Note form and contour.

6. Distal surface (d.). Note difference from mesial.

7. Gingival line. Note curvature for each surface.

8. Ridges. Locate and name those found on any surface.

9. Fossæ, grooves, pits, or fissures. Locate such as are found on any surface.

The root. Note carefully the general form and direction of curvature if any; also form, in cross section.

NOTE.—All the teeth may be analyzed in the same manner. Where such syllabi are used, page reference should be made to the text book (Black's Anatomy).

Practical Exercises.

There are four distinct methods in use for teaching tooth form.

1. The recitation method, using heroic models for demonstration, requiring the student to point out on the model and name the angles, surfaces, angles of surfaces, and surface markings, as ridges, grooves, pits, fissures, etc.

2. The drawing method, in which the student is required to draw the outline and to shade sufficiently to show surface markings—either normal size or enlarged to scale—of all the teeth, or of one of each class.

3. The modeling method, in which the student is required to model in clay, soap, wax, or some similar substance all of the teeth or a representative of each class, enlarged to scale.

4. The carving method, in which the student carves in ivory or bone one tooth of each class,—natural size.

The first method needs no explanation or commendation, as its use and value are evident.

The second method need only to be used to discover its value. Authorities differ as to whether drawings should be made natural size or enlarged, also whether they should be entirely freehand or laid out by measurement (to scale if enlarged). We would suggest that the value of drawing is twofold; it teaches form and it provides every student with a means of expression in quiz. Where enlarged drawings are used and are made to measurement, blanks (see p. 68, report for 1898) are very useful.

The third method was used before carving in ivory came into vogue, and some still find it useful to teach correct form before attempting the carving. The composite clay is the most practical substance to use, and the general directions given for carving may be followed, using of course measurements, increased to scale.

The fourth method is doubtless the best of all practical exercises for teaching tooth form. There is a difference of opinion as to whether the carving should be made to measure by Black's average measurements, which result in a composite tooth, or should be made by the eye after a selected tooth. Where the first method is employed the following syllabus has proved to be useful:

MACROSCOPIC ANATOMY.

Dissecting Longitudinal and Transverse Sections.

The points to be gained are:

1. The general form of the tooth in each aspect and the relative proportion of crown and root.

2. The amount and form of the dentin in each aspect.

3. The form and thickness of the enamel.

4. The pulp chamber and canals, their location, size, and form as shown by the different dissections.

Practical Exercises.

Here again we have distinct methods.

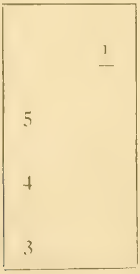
First method: Cutting longitudinal sections (one aspect) and transverse (gin. line and mid-root), mounting on card or blocks which bear printed annotation.

Second method: Cutting longitudinal sections, mounting on blocks; annotation made by student and silhouette printing on ruled sheet, as shown in Weeks's Manual, p. 11.

Third method: Mount on block and annotate ^{1}. File to expose pulp-chamber and canal; finish with fine sand-paper. (Every second man cuts a labial aspect, the others cut mesial aspects.)

Measure section cut in exercise 3, draw outline actual size, and record measurements on Form 2. (Each student makes measurements and drawings of each aspect of three teeth.)

Select and mount on block, ^{1}, having badly decayed crown; with a hack-saw separate the crown and root at gingival line; also divide the root into thirds, remount on block with large end up and annotate thus:



5. apical third.
4. middle third.
3. gingival line.

6. Make drawing actual size by measurement of sections cut in exercise 5 in proper place on Form 3. Each student make drawings of sections of three teeth.

All these methods have merit and are presented that teachers may select and combine to suit their special needs.

INSTRUMENT NOMENCLATURE AND CLASSIFICATION.

CLASSIFICATION OF INSTRUMENTS.	ORDER NAMES.	Those which denote the purpose.
	SUB-ORDER NAMES.	Those which describe position or manner of use.
	CLASS NAMES.	Those which describe the form of point.
	SUB-CLASS NAMES.	Those which describe the form of the shank.

Examples of Classification.

- Order.
  - Excavators,
  - Scalers,
  - Pluggers,
  - Accessories.
- Sub-Order.
  - Direct cutting excavator,
  - Lateral " "
  - Push scaler,
  - Pull "
  - Hand Plugger,
  - Mallet "
  - Gold "
  - Amalgam "
  - Root canal "
- Class.
  - Hatchet excavator,
  - Hoe "
  - Spoon "
  - Discoid "
  - Cleoid "
  - Sicloid Scaler,
  - Cleoid "
  - Smooth faced plugger,
  - Serrated " "
  - Convex " "
  - Flat " "
- Sub-Class.
  - Mon, bin, and triple angled excavator, plugger, etc.
  - Contra-angled excavator, plugger, etc.,
  - Spiral plugger,
  - Bayonet "

Instrument Lists.

Instrument lists or sets are made up of *ordinaries, side instruments,* and *specials.*

Ordinaries are the common forms of hatchet and hoe excavators.

Specials are those designed for special acts in preparing cavities; as spoons, enamel hatchets, chisels, etc.

Side Instruments are those designated for some particular purpose.

Technic.

The ideas of teachers vary so much as to the value of making instruments that any outline for a technic course will be omitted. Your committee would however indorse Dr. Black's opinion that students should be required to form the various instruments in the set from some soft material like brass. This work takes little time and impresses the formulæ upon the student's mind.

The proper care and sharpening of instruments should be taught in the technic laboratory.

Instrumentation.

In teaching the use of instruments there are certain points to be observed.

1. Grasps and rests.
2. The kind of work and place in the cavity for each form of instrument.

GRASPS.	PEN.	Holding the instrument as a pen is held in writing.
	INVERTED PEN.	Inverting the grasp so that the instrument is at right angles to the length of the arm.
	PALM AND THUMB.	Holding the instrument with the fingers against the palm of the hand so that the thumb is opposed to the working point.

RESTS.	FOR PEN AND INVERTED PEN GRASP.	By resting the third or fourth fingers, or both, upon a convenient point upon the teeth adjacent to the one which is being operated upon.
	FOR PALM AND THUMB GRASP.	By placing the thumb of the hand holding the instrument upon the tooth which is being operated upon, or an adjacent one.

NOTE.—The second point will be given in connection with cavity preparation.

CAVITY CLASSIFICATION, NOMENCLATURE, AND PREPARATION.

Classification.

CAVITIES.	PIT AND FISSURE. (No extension for prevention.)	Cavities in occlusal surfaces of bicuspids and molars and lingual surfaces of upper incisors.
		Cavities in the occlusal two-thirds of the buccal and lingual surfaces of molars.
	SMOOTH SURFACE. (Extension for prevention.)	Cavities in the gingival third of the labial, buccal, and lingual surfaces.
		Cavities in proximal surfaces of incisors and cuspids which do not involve the mesial or distal incisal angle.
		Cavities in proximal surfaces of incisors and cuspids which do involve the mesial or distal incisal angle.
		Cavities in the proximal surfaces of bicuspids and molars.

NOTE.—Cavities occurring in consequence of arrested development are not included.

CAVITY NOMENCLATURE.

This tabular presentation of cavity nomenclature is based upon Dr. Black's terminology and is intended to apply only to prepared cavities.

All that is to be said in describing cavity preparation can be expressed by the use of the following nouns and adjectives:

Cavity,
Wall,
Margin,

Surface,
Angle,
Thirds,
Embrasure,

Labial,
Buccal,
Lingual,
Proximal,

Mesial,
Distal,
Incisal,

Occlusal,
Gingival,
Axial,

Pulpal,
Sub-pulpal.

Cavity Names.

Cavities in the teeth take the names of the surfaces in which they occur.

- Cavity.
  - Simple.
    - Labial,
    - Buccal,
    - Lingual,
    - Mesial,
    - Distal,
    - Occlusal.
  - Complex.
    - Mesio-incisal,
    - Disto-incisal,
    - Mesio-labial,
    - Disto-labial,
    - Mesio-lingual,
    - Disto-lingual,
    - Mesio-occlusal,
    - Disto-occlusal,
    - Linguo-occlusal,
    - Bucco-occlusal,
    - Mesio-disto-occlusal.
    - (Other combinations by the same rule.)

Wall Names.

That wall of a cavity in an axial surface of a tooth that covers the pulp is called the *Axial* wall. If the cavity is extended to include the pulp chamber this wall takes the name of the wall of the pulp chamber. The bottom or floor of occlusal cavities is called the *Pulpal* wall. If extended to include the pulp chamber it becomes the ***sub-pulpal*** wall.

- Wall.
  - Labial,
  - Buccal,
  - Incisal,
  - Occlusal.
  - Lingual,
  - Mesial,
  - Distal,
  - Gingival,
  - Axial,
  - Pulpal,
  - Sub-pulpal.

Rule, cavity walls take the names of the surfaces of the tooth which they approach.

Angles. (*Simple Cavities.*)

- Angles.
  - Line (Axial).
    - Occlusal Cavities.
      - Mesio-buccal,
      - Mesio-lingual,
      - Disto-buccal,
      - Disto-lingual.
    - Axial Surface Cavities.
      - Bucco-axial,
      - Linguo-axial,
      - Mesio-axial,
      - Disto-axial.
  - Line (Pulpal).
    - Occlusal Cavities.
      - Bucco-pulpal,
      - Linguo-pulpal,
      - Mesio-pulpal,
      - Disto-pulpal.
    - Axial Surface Cavities.
      - Bucco-gingival,
      - Linguo-gingival,
      - Mesio-gingival,
      - Disto-gingival,
      - Axio-gingival (and combinations with occlusal wall).
  - Point.
    - Mesio-bucco-pulpal,
    - Disto-bucco-pulpal.
    - Mesio-linguo-pulpal,
    - Disto-linguo-pulpal.

Point Angles (the union of three line angles) take their names from the surfaces forming them. In occlusal cavities there are four.

In complex cavities on axial surfaces there is another horizontal line-angle, *i.e.*, in axial cavities combined with occlusal, the one formed by union of the axial and the pulpal wall—*axio-pulpal.*

Division into Thirds.

Cavities may be divided into thirds, for convenience in description, as teeth are divided.

Names of Margins.

Margins.
- Mesial,
- Distal,
- Buccal,
- Labial,
- Lingual,
- Incisal,
- Occlusal,
- Gingival.

Nomenclature of Simple Cavities.

Occlusal Cavities.

Walls.
- Mesial,
- Distal,
- Buccal,
- Lingual,
- Pulpal.

Line Angles. (Longitudinal)
- Mesio-buccal,
- Mesio-lingual,
- Disto-buccal,
- Disto-lingual.

Line Angles. (Transverse)
- Mesio-pulpal,
- Disto-pulpal,
- Linguo-pulpal,
- Bucco-pulpal.

*Cavo-Surface Angles.
- Mesio-occlusal,
- Disto-occlusal,
- Bucco-occlusal,
- Linguo-occlusal.

Point Angles.
- Mesio-bucco-pulpal,
- Disto-bucco-pulpal,
- Mesio-linguo-pulpal,
- Disto-linguo-pulpal.

Margins.
- Mesial,
- Distal,
- Buccal,
- Lingual.

Labial, Buccal, or Lingual Cavities.

Walls.
- Mesial,
- Distal,
- Gingival,
- Occlusal or Incisal,
- Axial.

Line Angles. (Longitudinal)
- Mesio-axial,
- Disto-axial.

Line Angles. (Transverse)
- Mesio-occlusal,
- Disto-occlusal,
- Mesio-gingival,
- Disto-gingival,
- Occluso-axial,
- Gingivo-axial.

*Cavo-Surface Angles.
- Based on the same rule as for occlusal cavities.

Point Angles.
- Mesio-axio-gingival,
- Disto-axio-gingival,
- Mesio-axio-occlusal,
- Disto-axio-occlusal.

Margins.
- Mesial,
- Distal,
- Gingival,
- Occlusal or Incisal.

Simple cavities on proximal surfaces have the same number of walls.

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*Cavo-surface angle.—An angle formed by a wall of a cavity and the surface of the tooth in which the cavity is situated.

angles, and margins as those on other axial surfaces and are named similarly.

With this basis all cavities, however complex, may be easily named and described.

Cavity Preparation and Instrumentation

In cavity preparation there are four definite steps. 1. Establish outline of cavity. (Outline form of Dr. Black.) 2. Remove *softened* dentin. 3. Give the cavity proper shape. In this step is included Dr. Black's resistance form, retention form, and convenience form. 4. Bevel and smooth the enamel wall.

First step. This includes the cleaving away of all unsupported enamel, which involves the use of chisels and enamel hatchets. The extension of fissures, which involves the use of drills, fissure and inverted cone burs in addition to the hand instruments. The extension of smooth surface cavities for prevention, which involves the use of round and fissure dentate burs in addition to those already named.

Second step. This is necessary as soon as the cavity is opened, that the student may become aware of the extent of the cavity and avoid pulp exposure, and should be done entirely with spoon and discoid excavators.

Third step. This includes resistance form, *i.e.*, the "seat" of the filling upon the pulpal or gingival wall; this involves the use of the hatchet and hoe excavators and fissure or inverted cone burs. The retention form or emphasizing of line and point angles with the same instruments. The convenience form or that form which enables the operator to insert the filling material with ease and certainty. As this is often simply a modification of the other forms, it naturally may involve the use of all the instruments.

Fourth step. This includes the correction of marginal outlines, which involves the use of enamel hatchets, chisels, and gingival-margin trimmers. The smoothing or planing of enamel-walls with the same instruments or with fine burs, stones or disks.

The final touches or "toilet" of the cavity which insures the operator that all is ready. This includes the thorough cleansing of all surfaces.

TECHNIC.

In teaching typal cavity form, one of several methods may be employed:

1. Preparing cavities, involving the principles taught, in heroic plaster models, either by measurement or "free hand."

2. Preparing cavities, involving principles, in ivory or bone blocks or carved teeth (either by measurement or "free hand").

3. The same in natural teeth.

Your committee find it impracticable at this time, for many reasons, to enlarge upon divisions five and six of the chart, and submit the foregoing with the hope that it will meet the demands of the School of Technics.

We desire to acknowledge the assistance of Professors Black, Johnson, and Harper in the compilation of the report.

THOS. E. WEEKS,
D. M. CATTELL,
J. A. DALE.

After reading the report, the speaker continued:

The report is submitted by your committee in the form it is that you might study it carefully and use such things in it as fit into your course. Your committee has tried where there were differences to refer to them all, and to give something that would cover each one. We did not expect that the various colleges would adopt this report in its entirety, but we hope that our labors may result in some benefit to all. We hope you will look with kindness upon the shortcomings of the report, as there were some things we cannot explain that rendered it absolutely impossible to devote the time to it of which it was worthy.

REPORT OF THE COMMITTEE ON A SYLLABUS OF PROSTHETIC TECHNICS.

Dr. H. J. **Goslee** read the report, as follows:

Gentlemen of the National School of Dental Technics: Even with the advantages and benefits derived from the preparation and presentation of our report of last year, and the very generous and wholesome discussion evoked by it, together with the thought and deliberation of another year's time, your committee, reappointed at the last meeting, has found it inadvisable at this time to offer further suggestions toward the presentation of an outline that might be sufficiently advanced over our last one to offer us any encouragement as being acceptable for your further consideration and approval.

While no concerted effort has been put forth during the last year, each member of your committee has given the matter very liberal thought, and considerable time has been devoted to the interchange of ideas, the result of which we hope may yet enable us to reach, in the evolution of things, a happy solution of that which seems at present to be a somewhat arduous task and a trying problem.

The difficulty, of course, lies not so much in the simple outlining of a course of prosthetic technics that might cover the ground and conform to the individual requirements, but in formulating something concise, yet sufficiently broad and complete, to meet with the universal requirements of the long and short-term colleges, and be as nearly as possible in harmonious accord with the variations in the amount of time devoted to this line of work and the individuality of the teacher.

Our former report, which was a composite of the united efforts of your committee, was presented in printed form to the members of this body during the sessions of the meeting, with the hopes that they might be thus enabled to study it carefully, criticise it, put it to a practical test, and let us know during the interim, or at this meeting, the result of their conclusions regarding its practicability, usefulness, and value, together with any and all suggestions that might occur to them.

This would prove of inestimable value to the furtherance of the work, and without which our efforts must necessarily be primitive and somewhat restricted, because our endeavor in compiling the syllabus we have had the honor to present you was simply as a suggestive measure, outlining not only the subjects to be taught, but the amount of time to be devoted to each, with a view of building a foundation upon which yourselves and your present and subsequent committees may work.

Realizing the many advantages that a suitable syllabus would offer the teacher of prosthetic technics as a guide and foundation for the systematic and uniform arrangement of the subject, and earnestly soliciting your necessary aid and co-operation in the work for the mutual benefit of this body and its further committees, this report is

Respectfully submitted,
N. S. Hoff,
Geo. H. Wilson,
H. J. Goslee,
Committee.

DENTAL PEDAGOGICS.

By A. E. WEBSTER, D.D.S., M.D., Toronto, Canada.

The subject of pedagogics is a vast one. It is undoubtedly more extensive than the whole subject of dentistry. In one respect it is similar to it, being a science and an art of the last century, in fact, we may say of the last two decades. To present both the psychology and methodology of the subject in one paper would take more time than is allotted to the subject on the program.

College professors of the twentieth century will look to their methods as well as to their matter. They will be great teachers, as well as proficient scholars. The average professor in the past cherished a deep contempt for methods. He counted it presumption to call education a science, and teaching an art. But a marvelous revolution is going on. Students who elect teaching will be educated for their profession. College professors of the future will be as noted for their great skill in teaching as for their great learning.

The time was, when a large practice was a sufficient qualification for a position on the teaching staff of a dental college. Later, and even now, the idea prevails that knowledge of the branches to be taught is all that is necessary to the equipment of the teacher,—that to know a thing, is to be able to teach it. One who knows how to make a beautiful piece of bridge-work is not necessarily able, because of that knowledge, to teach bridge-work well. Nor is ability to teach made up of the subject-matter, plus knowledge of the modes of growth and the operations of the mind, but it demands a thorough knowledge of mind, matter, method.

In the study of this subject we should expect to put forth an effort to attain the best results. We must expect to gain a knowledge of it by the same processes as our students gain a knowledge of dentistry. If we are the pupils of the "School of Dental Technics," as our name implies, we should work in sympathy, not expecting a very great deal from any individual, but a great deal from the whole membership. Just as we find it in those happy institutions of learning where professors and students are in perfect sympathy one with the other, having a common object, that of getting the best out of a college course. Just here I cannot refrain from the remark that in such institutions there is nothing heard about rules of conduct, nor harangues on discipline.

In a general way, what might be considered a good method of presenting a subject to a dental student, should be considered a good method of presenting a subject to this association.

Our best teachers do not believe that a stereotyped written lecture or lesson is productive of the best results, nor does the writer see why all the subjects presented before this association should be written out in full. Of course, scientific subjects are best presented in exact form, but those of a practical character are better presented according to the exigencies of the case at the time of presentation. Accordingly, the scientific portion of this paper will be read, while that portion pertaining to the art of teaching will be demonstrated.

All will agree that three terms at a dental college is too short a time to master the whole of dental science. This being true, why should we wander over the whole field without knowing whether our students are obtaining anything substantial or not? The true teacher lays such a foundation that the student is capable of filling in the details for himself, thus giving to him the pleasure of conquest. Again, the true teacher imbues his pupil with such an interest and enthusiasm in the subject, that it is studied with pleasure after he leaves college.

The great essential in all teaching is to create in the pupil an interest and enthusiasm in the subject. One of the best means to this end is by the direct method of teaching, having no hints, aids, or assistance to memory that are not allowed to the pupil. The teacher should put such energy and feeling into his teaching that the student will be carried away and the teacher in turn will feel that sympathetic touch that comes from the student. Have you ever felt it? If not, put more soul into your work.

Instruction is usually given by one of the following methods: Lecture, demonstration, Socratic, recitation, or some combination of these. Let us briefly consider these methods and their adaptability to our needs as dental teachers.

By the lecture method of teaching is meant a direct continuous exposition, without the aid of demonstrations, practical exercises, quizzes, or recitations. This method is rarely strictly adhered to, except, perhaps, in theological colleges. Very few professional colleges of the present day depend entirely upon this method for the instruction of their students. The demand in medical and dental colleges for more demonstrations, clinics, practical exercises, quizzes, and recitations is increasing. This demand is in the right direction, and is based upon correct principles.

The lecture method has the advantage of being more rapid than any other method of teaching, and is also adapted to the instruction of large classes. The great disadvantage of this method is that the teacher does not need to know the subject-matter, the pupil, or himself. He needs little or no energy; in fact, he may read or dictate his whole course of lectures. He may follow a rut for years, and keep his classes quiet by forcing them to take notes which are rarely ever read afterward.

The demonstration or clinical method of teaching consists in the presenting and describing of objects, and the performing and describing of procedures. Objects, drawings, models, and photographs are used to advantage in this method of instruction. This is the only true method of presenting the first lessons in a scientific subject. Note this, object first, description immediately after, then practical exercise. The child gets its first ideas from the sensations of touch and sight. The adult the same. Presentative ideas must precede representative ideas. After the pupil has a full stock of sensations out of which to make representative ideas, lectures and descriptions may be given without the aid of objects. To apply this psychological principle, which should come first,—practical chemistry or theory of chemistry, practical anatomy or theory of anatomy, practical histology or theory of histology, practical materia medica or theory of materia medica, practical exercises in dentistry or lecture of dentistry? I leave this question with you.

The demonstration method is slow, and always defective unless followed by practical exercises and recitations. The teacher must have a thorough and wide knowledge of the subject, and be competent to do anything that he asks his pupils to do.

The recitation method should hardly be given the dignity of being named as a method of teaching. It consists in setting lessons [illegible] a text-book, which are to be learned by the student and afterward recited upon. This method is entirely obsolete in all primary schools. It is the method adopted by the old-time school-keeper. It requires the least possible amount of energy and knowledge from him. It has the great advantage of compelling the student to *work*. At the present time there is a tendency to introduce this method into dental and medical schools. One book is learned by heart and the examination is set upon it. To say the least, this is narrowing and restricting mental growth.

The Socratic method of teaching leads the pupil by judicious questioning to form new conceptions. This method has the advantage of getting the undivided attention and thought of the pupil, perfect order in the class-room, the teacher knows the exact capacity of the pupil. This method demands of the teacher a thorough and systematic knowledge of the subject, and a great deal of skill and energy in the art of questioning. He must also know either the names or numbers of his pupils. The plan of teaching the lesson must be prepared. The questioner must have a trained intellect. He should possess analytic power. One thing at a time, and it in its logical connection. Disconnected questions are the product of a muddled brain. The illogical mind cannot teach because it does not reach correct conclusions, nor does the pupil see the connection or relation one question or subject bears to the one preceding it. These demands are so great that but few teachers are following this method in our dental colleges.

By the combination method of teaching, is meant an adaptation of the method to the subject and to the capabilities and progress of the pupil. Such subjects as dental ethics and general rules of practice may be taught best by lectures, quizzes, and recitations, while anatomy, materia medica, prosthetic and operative dentistry are best taught by demonstrations, clinics, practical exercises, lectures, quizzes, and recitations. (Note the order.) Well-directed questions at proper intervals before, during, and after a lecture will arouse attention, while, at the same time, the answers will indicate to the teacher how well the subject is being comprehended. Thus there is no waste of time in lecturing upon subjects already understood, nor does the teacher lecture over the heads of his pupils.

Recitations, conducted as reviews, are very helpful to retention and to make clear ideas that were at first hazy. Practical exercises that follow demonstrations and clinics are reviews, as is the manual training. The idea must be present before the hand can execute. Written examinations have an educational value when properly conducted. The reproduction of knowledge is a sure sign of its presence. The teacher should avail himself of every means possible to assist his pupil to gain and retain knowledge.

Psychology bears the same relation to the science of education that anatomy, physiology, and pharmacy bear to the practice of medicine. It is as necessary that the teacher should know something of the mind's activities as it is that the physician should know the bodily organs and their functions, their normal and abnormal conditions.

The teacher should be able to tell why he teaches anatomy or physiology, and why he teaches them in a certain way, as the dentist should be able to tell why he puts a crown on one root while he extracts another. Just as the dentist should know the specific effect of any medicine on the tissues of the body, so the teacher should know the effect of a given college exercise or branch on the different faculties of the mind.

BASIS OF INSTRUCTION.

(*a*) Always base instruction upon some activity of the pupil,—*i.e.*, interest, habit, impulse, activity.

There must be personal or self-activity. Education is the development of the psychical activities. What stimulates to activity once is not likely to do so again.

(*b*) Always base instruction upon some interest of the pupil. May be interested because of sympathy, desire of progress, of knowledge, or its manner of presentation. (Note what excites interest.)

Interest is an emotion, not an intellectual act. Out of this interest grows attention.

(*c*) Always base instruction upon some idea already existing in the mind.

A new idea must be lodged about an idea already there. We always learn with what we already know. An idea (however vague) of what is to be done must precede any doing.

AIMS OF INSTRUCTION.

(*a*) Aim at making instruction significant. First make each subject, as a whole, significant; keep the whole subject in relation or bearing with what the pupil has already done in the subject.

Explain every new law, fact, or statement so that it may be translated into old perceptions.

(*b*) Aim at making instruction definite. Every lesson should have a point and every question upon that lesson should have a point, precise, salient. Unambiguous, irrelevant matter should be excluded; the teacher should avoid the introduction of confusing examples. Objects presented must plainly illustrate just the point desired. A great deal of scientific experiment and illustration is wasted because the student observes only the most attractive point. Every expression of the pupil must be definite, but the teacher must remember that ideas are at first cloudy and vague, and are only made clear by the student's mental activities being aroused to work upon them.

(*c*) Aim to make instruction practical. Instruction is practical when ideas lead to action and action is based upon ideas, that is, that it may give the student the power to act. So instruct that the student may organize his faculties and powers to develop association and attention, apperception and retention.

METHODS OF INSTRUCTION.

(*a*) Teach one thing at a time. Why?

Because (a) it economizes mental energy, (b) defines mental products, (c) excludes irrelevant material, (d) prepares the way for memory, (e) fosters the analytic habit. A well-trained mind grasps the salient points in a subject first. Teach the whole before the parts.

(*b*) Teach in a connected manner. It demands of the teacher:

1. Unity of aim or an educational ideal. Have a broad practical ideal; aim to teach correct habits of mind.

2. That the teacher be systematic. Have a definite aim for a whole term's work and carry it out in a systematic order; leave all details to existing conditions at the time of lecturing.

3. That instruction be graded,—easy to difficult, simple to complex, familiar to novel. In this connection it might be well to call attention to the too frequent condition in some of our schools

of having the same class listen to the same lectures in two different years. And what is worse, these lectures are identical for years, and in some cases, dictated, being copied verbatim by the students. And what is still worse, the examination is set on what has been dictated.

A. The synthetic method demands that knowledge begin with presentation, because all representative knowledge must be capable of translation into presentation. By this method, the faculties of the mind are trained in the order of their development, perception, memory, imagination, reasoning. The two factors in training perception in order to establish a connected growth from it, are,—first, identifying the presentation with what has already been presented (recognition); second, the discovery of something implied in the perception, but not apparent on its surface (differentiation).

New knowledge is only obtained by discovering its relation to old, and the old is strengthened, extended, and developed by the new.

B. The synthetic method demands that facts be connected by the laws of association, and by the relation of unity and difference, so that they form centers or groups of ideas. An isolated fact is learned by the pupil only through sheer force of impressing it upon the mind. In youth, this method may succeed so far as collecting a number of facts is concerned, but there is no power given to organize new knowledge. Simply dead matter obtained after the expenditure of a great deal of force. While facts are learned by association and relation, they serve as centers around which allied ideas gather, thus helping to carry others instead of having to be carried by the energy of the mind.

C. The synthetic method demands that the groups of ideas thus formed be used as organs for acquiring new knowledge.

First.—Old knowledge should be reviewed, grouped, and classified. The serial order should often be changed to the topical. The pupil should be often required to rearrange the principles of a subject.

Second.—The mind must be prepared for new ideas by stirring up ideas already there, reawakening an interest and showing how these ideas lead naturally to others.

Third.—Old knowledge must be exercised and its relation to the new shown. Keep the old separated from the new and they are retained with an effort, but united one assists the retention of the other.

The analytic method demands that the teacher should first present the whole, then parts; first, outlines or groups, then details; *e.g.*, a child sees a man first as a whole body, then legs and arms are made out; later, head, face, eyes, fingers, toes, and so on, until the whole detail is completed. This is the groundwork of our present methods of instruction. Our children are taught first the sentence, then the word, and then the letter. Nowadays, we frequently see children who can read well and do not know half of the alphabet. I venture the question,—Are we teaching anatomy, physiology, materia medica, and pathology correctly? Do we give our students a grasp of the whole subject first, then take up its parts and so on down to details, or are we, as in physiology, beginning with details,—*e.g.*, cell and tissues, and then giving the whole? These questions I leave for your consideration.

Studies are valuable for two reasons,—for the culture they afford, and for the use that can be made of them. In primary education the culture a subject affords is of chief importance; while in professional education, the usefulness of the knowledge obtained from the study of a subject is of chief importance.

Grant that the subjects taught in a dental college should be useful; that usefulness does not hinder them from being valuable as a means of mental culture, if taught according to psychological principles. A subject taught contrary to the natural channels of the mind, cannot afford a means for mental growth. Anatomy is most admirably adapted to the education of perception (a faculty of very great importance to the dentist), but how can a student's perception be educated if he does not see the cadaver before he reads his "Gray"? The faculty of memory may be educated by every subject on the dental curriculum if taught according to the laws of memory. How can attention and concentration be educated if the teacher lacks the power to gain and maintain the attention of his pupil?

Physiology is well adapted to the education of the analytic habit of mind if taught properly. Hear what Professor Roark says: "A logical presentation of physiology would begin with the cell and tissues of the body and trace their combinations into organs and systems. But it would be unwise to teach the subject in that way. Tissues and cells should be the last things taught." Pathology, operative and prosthetic dentistry, and orthodontia afford the greatest possible opportunity to educate conception, thought, judgment, and reason, if taught properly in the lecture room and infirmary.

Sympathy is the greatest governing and educating power at our command. Where there is sympathy there is interest and all that flows from it. To teach well, the teacher must get very near the student. It is impossible to get near a student without knowing him, and the workings of his mind. This winning of affection and confidence can only be done by having sympathy for the learner in his efforts and in his failures. A man that has but little sympathy can never be a teacher in the best sense of the word. He may be a hearer of recitations, an expositor of subjects, a martinet of discipline, an enforcer of spurious attention, a prince of rule and routine, but he has no power to touch the heart. It is hard to get implicit trust from students, but it is won through sympathy. In the general management of a college it is felt, but especially in the class-room where teaching is done by the interrogative method does the questioner's sympathy reveal itself and win the interest of the pupils. He is interested in instruction for their sakes, and they become interested in it for his sake, because they have utter confidence in him.

The true teacher always knows when his mind is out of contact with the minds of his pupils. He has at first pitched his questions or exposition too high or too low; he has failed to excite interest because he has failed to create the necessary relation between their old mental experiences and the new. But he soon corrects his error; he quickly touches the responsive chord, and he feels, and the students feel, that teacher and taught are one in thought and aim. Now, while the entire atmosphere of the college is one of sympathy, and thus influences the general college life, it is in actual teaching, especially by the method of interrogation, that it works with personal power. There is a focusing, so to speak, of the forces of sympathy, just as there is a concentration of the intellectual activity in attention; in fact, the latter depends in no small degree upon the former. Under this condition, effective teaching is possible. The teacher has an insight into every mind; he adapts every question to its needs and arouses it to normal action, and breathless interest and brightening eye prove that his labor is not in vain.

Personality is a large factor in teaching. Sympathy, we have seen, reveals itself and calls forth the sympathy of pupils, through contact and questioning. The lecturer stands afar off; he may excite admiration, but he cannot create the strong bond of sympathy which is the work of admiration and gratitude which is essential in all true education. But the sympathetic questioner works his way into the hearts of students.

Sympathy, united with enthusiasm, constitutes a powerful personality. More than anything else it is this personality that makes the successful teacher. Learning and method will be of little worth unless there is interest and enthusiasm in the work, for this alone can arouse the interest and stimulate the powers of the student. The fundamental principle is that personality communicates itself, that there is developed in the pupil the same state of intellectual and moral consciousness that marks the teacher. If a subject has no interest for a teacher, it can have no interest for the taught, but sympathy, strengthened by enthusiasm, will make the irksome or even the repellent, attractive.

In the past this association and dental faculties in general have spent much time on the: *What* should the student be taught. Now the tide has changed to, *How* should the student be taught. Lest we should be carried away by the *how*, let us *not* forget the personality of the teacher. No mechanical method can possibly be substituted for this personality. It is the power that insures clearness, force, and permanent effect to all lesson-giving. More than knowledge, it imparts love of knowledge and ability to acquire it.

In the discussion about methods, therefore, it should be remembered that the true method of the educator is not to be found among the scores of ways, plans, devices, methods that are so often enumerated; it is the method of personality. Erudition, knowledge of mind, and normal method have their place,—a high place. But the highest place must be given to personality. The most permanent influence the world has known, or perhaps will know, may be traced to its forming and transforming influence. It operates in the college with far-reaching influence. Too much reliance on methods as methods makes education mechanical, dull, deadening, benumbing, destructive of vitality in both teacher and pupil. This is due to the exaggeration of the mechanical powers of the teacher and its substitution for vital power. Give the student's mind a chance, do not destroy or enfeeble it by spoon-feeding, or putting in its place a machine which you yourself have modeled. Let the student think for himself, and draw his own conclusions.

I wish to thank Professor Hume, of Toronto University, Professor Locke, of Chicago University, and Professor Murray Butler, of Columbia College, for valuable assistance in the study of this subject.

Works read in the study of this subject: "Dewey's Psychology," "Psychology for Teachers," by Morgan; "James's Psychology," "Psychology, Applied to the Art of Teaching," Baldwin; "Applied Psychology," McLellan; "Psychology in Education," Roark; "School Management," Baldwin; "Fitch's Lectures on Teaching," "Spencer's Lectures on Education," "Gaining and Maintaining the Attention," Hughes; "Mistakes in Teaching," Hughes.

Dr. Webster, after reading a portion of his paper, illustrated his method of teaching by blackboard exercises, and also passed around among those present sections of teeth. He, in addition to the matter contained in the paper, said,—

At this place I intend to teach one point. It is a most difficult thing to teach men who already know too much. What I intend to teach is the shape of a pulp-chamber of an incisor in the same manner I would demonstrate it before my class. The first thing is to know who the pupils are, and what they know. We expect them to know the general shape of the central incisor and the general shape of all the teeth; the external appearance of all the teeth. We expect them to know the crown from the root, and the general shape of the crown. Always teach your lesson just the way they want you to. For instance, if they demand a picture on the board, we will have to make it for them.

I want you to look at the labio-lingual section, and then compare the mesio-distal section at the incisal edge. But we must find out if the pupil has an idea of what is contained in the pulp-chamber.

Q. Take the tooth itself, is it wider at the labio-lingual than the mesio-distal (to Dr. Hoff)?

A. It is.

Q. That was a bad question. You can't do these things just as one would like to. We will follow that on. Do you notice anything about the point coming up on that labio-lingual section toward the incisal edge?

A. Yes.

Q. What is peculiar about the way that comes up? (to Dr. Darby.)

A. I don't quite comprehend the question.

Q. Certainly not, because it is a bad question. We will try it another way. In the labio-lingual section you notice it is very much narrower. Does that narrowing increase or decrease as it goes toward the incisal edge?

A. It enlarges; then it is constricted, and then it enlarges again in the specimen I have.

Q. In the labio-lingual section, does it become wider as it goes toward the incisal edge?

A. Yes, sir. It is wider than it is at the juncture of the root with the crown.

Q. How does that run up now? (after explaining.)

A. It is larger.

Q. Does it increase or decrease as it goes up?

A. It decreases.

Q. Does it markedly decrease right opposite the very edge?

A. I think it does.

Q. How would you describe that point right there? (to Dr. Johnson.)

A. The labio-lingual walls of the pulp-chamber gradually diverge and then pass rootwise.

Now, gentlemen, you know too much about these things, but if I were to ask a student he would say that it gets narrower as it goes up; in fact, it gets thin. That is the difficulty, as I told you when I started; these things don't come out the way you can develop them. Now, we have made out two points; that it is wider mesio-distally than labio-distally, and that it becomes very thin as it approaches the morsal surface.

Q. Now, the greatest diameter of the pulp-chamber is at what point? (to Dr. Morgan.)

A. Near the gingival line.

If I were in a class I would ask one, How do you find it? He would answer, and another would say, "That is not so in this case."

Vote at once; see how many men say it is and how many say it is not. You see, we are educating perception.

We come to the root-canal; and what do we notice with regard to its size as we come toward the apex? (to Dr. Brophy.)

A. In the specimen I have there is scarcely any contraction at all until you reach the last third of the root.

Dr. Hunt. Mine gets smaller all the way down.

Q. The root in general is—?

A. Circular.

We find that the pulp-chamber is wider mesio-distally than labio-lingually; we find the root-canal is circular, and that the root of the tooth itself is circular. What is the general relation between the pulp-chamber and the tooth?

A. It approximates the former.

That is what I expect to come from the student.

Q. If that be true of the central incisor, what are you going to say of the rest?

A. The same rule applies.

The point is that the pulp-chamber and the root-canal are the same shape in general as the tooth itself. If I ask my students what about the third molar, if he knew the anatomy of the third molar he would know that of the pulp-canal.

The student comes to us as a rule knowing nothing, we will say. When you begin to talk to him about flasks and vulcanizers and vulcanizing, and all these things, the whole thing is a sea to him. He don't know anything about it. I know I didn't, and I didn't get any use out of the lectures for a long time after I started. The first question should be to present the thing rightly before the student. Let him see something, and then he can build in the rest himself.

DISCUSSION.

Dr. C. N. Johnson. Having in mind very vividly the resolution of Dr. Hunt at the beginning of this session, and having respect for the Publication Committee of last year, whereby an intimation was made that all discussions be prepared in advance, and, as I understood it, written out, to the end that there would be as little time wasted as possible, I have ventured to do something I have never done before. I have written out my discussion.

For scope, breadth, and a general grasp of the subject the paper we have just listened to seems to me the most comprehensive of any we have ever had presented to dental teachers. It is a paper that cannot carry its full significance home to the association by a single reading. It must be studied when in print to get the most out of it, and even then there are some of its features which are so much in advance of contemporaneous thought on the subject among dental college teachers that I predict it will take years before its full significance is appreciated by everybody. A higher compliment to the essayist than this I cannot find words to convey.

The science of teaching how to teach is almost a new one to dental teachers, and it is surely time that some attention was given this subject. We are not doing our full duty to our students unless we give them the most and best that can be given them in the allotted time.

The two prime divisions of his subject seem to be the methodology and the psychology. I am a firm believer in method, but I have not yet grown to the idea that a uniform method can be taught to all teachers, or that it would be productive of the best results if it could. To carry this idea too far would be to make mere machines out of our teachers, and destroy the sublime soul of individuality. After all, it is largely the personality of the man that brings conviction home to the student, and, as the essayist has so truly intimated, no man need expect to excel as a teacher unless he be in the closest possible sympathy with his class. There is a science to teaching almost entirely distinct from other kinds of ability, and to be an able practitioner does not necessarily carry with it the equipment to teach.

The prime requisite of a teacher, as I look upon it, is the ability to stimulate thought on the part of the student and develop his reasoning faculties. So soon as you have started a student to thinking seriously on a subject, so soon have you attained the greatest measure of accomplishment toward its understanding. To this end no teaching is effective which is done in a perfunctory, cut-and-dried manner. Written lectures are simply an abomination and an offense to an intelligent class. The only aid in the lecture-room, aside from the illustrative accessories, should be confined to headings of subjects, and this merely to render the work orderly and systematic. To this end a teacher should be saturated with his subject, and no man who aspires to teach should be devoid of this qualification. It requires the eye to eye contact with the class to make teaching most effective. The sparks must fly from teacher to student, and from student to teacher, till both are keyed up to the highest pitch; and not till you attain this exalted condition are you doing the greatest good to your class.

Along this line, I am rapidly forcing into disfavor the practice of taking notes of lectures on the part of the students; at least in the presentation of my own particular subject, operative dentistry. I aim to stimulate my students to think, and if there is anything I abominate in college work it is the idea of students learning a thing by rote and repeating it like a parrot. The taking of notes interferes with the uninterrupted attention of both student and teacher. The moment you lose a student's eye, that moment half your force of conviction is gone. To uniformly hold the attention of a class, the manner of presenting a subject must be varied; it occasionally must be varied many times in the same lecture. And in this connection the plan of having stenographic reports made of lectures has always seemed to me objectionable. The lecture which reads well when reported is not always the most beneficial to a class, and *per contra* the lecture which carries conviction home to a class and leaves its indelible impress upon their minds would not by any means furnish smooth reading.

The psychological feature of teaching has more and more an absorbing interest to me, and I have always considered it the most fascinating phase of this subject; but the essayist has so ably touched upon it that I do not consider further elaboration necessary.

To sum up briefly, I believe that to be a successful teacher a man must first of all be in love with his profession; then with his special work as a teacher, and last, and to my mind most important of all, he must be in love with his students. He cannot do the most effective and permanent work without that bond of affectionate sympathy which the essayist referred to, where both teacher and student are working in harmony to get the most out of a college course.

I am also convinced that the element of personal integrity and sound morality enters largely into the question, for I am forced to believe that unless a teacher is built up of the purest moral fiber himself he will fail to impart that particular element to his work which makes most for the best development of his students. This view of the case gives us the most exalted sense of our responsibility as teachers, and if a man have not this in his heart he would better abandon teaching. We should also lose sight of the narrow conception which leads us to look upon this question of dental college teaching as it affects only ourselves and our students. The greatest result of our efforts relates not to the influence upon classes under our immediate instruction, but to the influence they carry with them out into the world and impart to their patrons. It is this double projection of our work that should demand of us the closest attention and the most painstaking effort.

Dr. A. H. Thompson. This question interests me deeply, and I think it is interesting and important to all; but there is one thing I think the paper missed, and also the discussion of Dr. Johnson, and that is the vital element of enthusiasm. It seems to me the one vital element of success in teaching is enthusiasm. In my little field I have often been impressed by the apparent amusement of some of the scholars by the enthusiasm that I would throw into the subject, but I take it as a good sign that they were impressed with the fact that I was enthusiastic. Enthusiasm becomes contagious. That is an important point.

Dr. H. A. Smith. I want to take back some things I said this morning if we are going to have papers like this and this kind of discussion; I don't care whether it comes from the Faculties Association or any other body. In this little side talk of the essayist about asking questions I noticed how he put them. It is a very important matter, and his method is simply admirable. He didn't say "Dr. Hunt" first and then put the question, but he put the question first and then called upon Dr. Hunt to answer it; and it makes a great difference whether you adopt that method or not. It has been suggested before, and I try to adopt this method, but I am so firmly fixed in the other that I forget about it half the time. The students are not half awake, you know, and when I put the question, calling first the name, the other fellows go to sleep; so you see the advantage of this method.

The essayist seems opposed in toto to the method of reading lectures. Of course he is correct, and that reminds me of a remark of Dr. Black a year or two ago. We were talking about teaching methods in dental colleges, and he said, "So far as reading lectures is concerned, I have abandoned all that, and each year I burn everything I had the year before, notes and all. I throw them away bodily, except some few things in the way of data and tables. I just burn the bridges behind me." I think that is the true teaching method. If you don't know the subject thoroughly, study it before you go into the class. Be full of it, as Dr. Johnson says; "be imbued with your subject." The manner of asking questions is important, and then you have something that you never had before in a paper on that particular subject.

I would like to know how they do it in Philadelphia.

Dr. E. T. DARBY. I don't like to have the subject passed without a word or two of commendation for the valuable paper. There are many points in it that are extremely valuable.

I cannot agree with Dr. Smith that a man ought to destroy everything of the preceding year. I have been twenty-five years getting together my notes. I hope you will not think they are all twenty-five years old; that is, that my teaching is twenty-five years old. But there are many things that would slip a man's memory in the matter to be presented to a class unless it was tabulated and arranged in an orderly way. I have before me my book of notes, and sometimes I refer to it once or twice, perhaps three times, during a lecture; sometimes half a dozen times, because without it there is a possibility that I may overlook some important matter that will pass my memory at the time and might occur to me after the lecture was over. It refreshes my memory upon some important fact in connection with what I am endeavoring to teach. So I think notes are useful. But, as has been said, written lectures before a class of intelligent students or not intelligent would be an abomination. I can conceive of nothing more prosy than to sit and listen to a written lecture, but the personality of the lecturer would have a great deal to do perhaps with its being tolerated; some men read remarkably well. I have listened to written sermons that were a great deal better than oral ones, and I have thought sometimes a man would read his sermon better than preach extemporaneously. But I think to sit seven, eight, or nine months and listen to descriptions of filling and treating teeth, of orthodontia, or prosthetic dentistry in any form, a written description would be almost intolerable. I believe there are some teachers in our dental schools who choose that method in preference to the extemporaneous method of speech.

I have been exceedingly interested in what Dr. Webster has done in the past, and I am pleased to bear testimony to the superior way in which he presented the subject this afternoon.

Dr. Webster. I wish to thank the gentlemen who have spoken such kind words of commendation in this connection, and just want to say that the particular methods that might come out in any teaching was not in the paper at all. That was not the intention. The idea was pedagogics, and that, of course, includes psychology and pedagogics in general. The matter of questioning, for instance, might come up, and the matter of taking notes. There should be something given on that subject. As to taking notes, an abundance might be said on either side, and on the subject of questioning also. Hughes writes a whole work of probably four hundred pages on the subject of asking questions, and that might be taken up very profitably. He also writes on the subject of attention; how to gain and maintain attention, a very admirable work. These are all subservient to the general principle.

As to notes, I am a firm believer that notes are an abomination. In my own work I ask the students to put the notes behind them. In fact, I tell them I don't want notes at all, or any study on the subject at home. They may think about it, but I don't want them to go home and read notes. I feel that if I can't pound it into them there, there is something wrong. It is really what they carry away in their minds that is of importance, and not what they carry away in their note-books.

THE USE OF THE BLACKBOARD IN TECHNIC.

By A. DE WITT GRITMAN, D.D.S., Buffalo, N. Y.

There are as many ways of imparting information to others as there are senses by which we can receive instruction. We may convey knowledge by the sense of sight, feeling, smelling, hearing, or tasting. Some kinds of information are best imparted through one of these senses, and some by others. Perhaps the one most widely used is that of taste, which governs the selection of the food of many animals who are without any of the other senses.

There are methods of teaching human beings who are deprived of some one of the senses. When without sight, information is conveyed through the sense of hearing or the sense of touch, but there are cases in which an individual is deprived of the most of the senses. Laura Bridgman, for instance, was inclosed within an impenetrable wall through which there seemed no opening. She had practically but one sense, that of feeling. Hearing, smelling, taste, and sight were either wholly absent or nearly so. This seemed a case in which it was almost impossible to educate, and yet by the persistence of one man this naturally very intelligent woman became comparatively well educated and accomplished, all her knowledge having been received through the sense of touch. So extraordinarily was this cultivated that she was able after it had been awakened to form logical conclusions drawn from a mere manual or digital knowledge of an object.

In human beings probably the sense of sight has more to do with mental development than any other. It is that upon which they must chiefly rely; not only to guard against injuries, but for investigation into hidden matters. Yet the power of speech, which appeals only to the sense of hearing, is that which was probably most early employed in the schools.

The ancient philosophers of Greece, who founded schools, and who were engaged in disseminating their doctrines, taught through the sense of hearing, their instruction being given in the form of lectures. Plato, the Athenian, founded a school of philosophy, and delivered instruction to his disciples in the groves of Academia. Aristotle was accustomed to lecture to his special students in the morning, and in the evening to a promiscuous audience in the Lyceum. Aristophanes, Diogenes, and Socrates appealed only to the sense of hearing. Although some of them wrote many books, yet their instruction was given in the form of lectures.

Modern methods of teaching are materially modified. For the very young text-books are provided and tasks must be learned, their intellect being cultivated through their sense of sight. In the kindergarten system of instruction the sense of sight is almost alone employed, the object being chiefly to cultivate a knowledge of form. In professional schools and higher universities the hearing is chiefly employed, and instruction is imparted by lectures, because it does not consist of axiomatic principles and arbitrary rules, which are the result of personal experience and experimental knowledge that cannot be embodied in any text-book. Professional instruction is continually changing with altered circumstances. No two cases in practice can ever present precisely the same conditions, and no two should ever be treated exactly alike. There is certain information which cannot possibly be conveyed by either sight or hearing alone. A union of the two becomes necessary to produce the best results. Object-lesson teaching has assumed very great importance, and is now very widely employed in almost all forms of instruction, especially where it is necessary to convey any idea in morphology. This method is adapted not only to older persons, but it appeals peculiarly to the young; and the kindergarten methods are simply a development of this form of instruction.

There are certain ideas which it is absolutely impossible adequately to teach to one who is without the proper sense, although another faculty may be so developed to take the place of that which is missing. A blind man can have no clear conception of colors, nor can a deaf man fully comprehend musical harmony.

It should be comprehended that a general education does not mean instruction of the brain alone. Especially to a man in our profession is education of the fingers of quite as great importance as that of the intellect. There are forms of manual training which are absolutely essential to the production of any good results in many kinds of study. For instance, the pianist must go through a regular form of instruction in digital discipline, and all children may, with a great deal of propriety, be trained in manual dexterity. American dentists have probably excelled all the rest of the world in operative work, because American children and Americans generally are especially trained in many forms of technics. We find among German dentists who are graduates of the universities probably the highest development of intelligence, but as a usual thing such men are very inefficient as operators. Their brain has been educated at the expense of their fingers.

The experienced teacher can readily detect the student who has had some form of technic instruction. In the present Freshman class of the Dental Department of the University of Buffalo there are three young men who at the outset showed unusual adaptability and readiness in the use of tools and an educated mechanical sense. They seemed at once to comprehend the result that it was desired to bring about, and to know how to produce it. They handled tools dexterously, and did not seize a fine carving instrument overhand, as if it were a pickaxe. They had that flexibility of the thumb which is only found in those who are accustomed to fine mechanical work. On inquiry it was learned that the father of one of them is a blacksmith, and the boy had passed his spare hours at his father's forge. Another had been employed as a needle-grinder, while the third had spent some time in a jeweler's shop. All these three widely varied employments had alike developed the mechanical sense and the technic ability sufficiently to place them decidedly in the lead on their constructional work.

Another student has always been in school, and is a graduate from a literary college. His parents are wealthy, and there has never been any necessity for other than mental exertions on his part. This young man has picked up his oral instruction with the greatest facility, and has quite taken the lead in such studies as anatomy, while it seems almost impossible to teach him the simplest elementary principle in mechanical construction. Although he is well informed in the laws of natural philosophy, what he really needs is a year in some employment which would develop his mechanical sense and educate his fingers.

In this country, as in most others, the digital training of women is usually confined to a very few pursuits. They become expert with the needle, but it is commonly remarked that a woman cannot drive a nail straight with a hammer. That is simply and solely because her manual training has not been in that direction. Certainly she has as much intelligence as man, but her technical work has not been the same. The boy is continually hacking something with a hatchet, or whittling out toys, or driving nails, while the girl is employed in stitching, embroidering, or in making dolls' clothes, in which she becomes expert, and which the boy would find beyond his manual capabilities.

In all the forms of manual training the sense of sight is of the very highest importance, while comparatively little can be conveyed through that of hearing. Words give no idea of morphology or of proportion, nor of the relation of one part to another. A lecture may impart definite principles upon which anything is done and the rules and laws which govern the application of those principles, but it cannot illustrate the methods of instruction. A teacher might lecture for an indefinite period upon the various forms of teeth. With most exact minutiæ he could describe the tubercles, the sulci, and the various lines without imparting to the student any clear idea of what one looks like, unless he had the object-lesson itself to show its morphology and appearance. He may even exhibit a tooth to a student and point out its various anatomical proportions, and thus convey a clear idea of what it really is; but the minuteness of the object allows him to present it to but one at a time, whereas the necessities of class teaching demand that he should be able to illustrate the same thing to a considerable number. Hence it has been usual for teachers who are instructing in tooth morphology to have large sectional models made, which may be exhibited to the sight while the lecturer is describing the various parts to the ear.

In teaching crown- and bridge-work, while a part of the instruction can be conveyed by lectures or through the sense of hearing, the main portion must necessarily be by object-lessons accompanying it, and even this involves difficulties. In making minute portions the parts are not large enough to give a clear comprehension of them. It would be impossible for the teacher to convey the proper meaning by saying to the student that he is to make a circular band. That is very indefinite. It gives no idea of the width nor of the proportions of the band which is to be constructed. On the other hand, he may exhibit the band already made and soldered, but that precludes the possibility of explaining clearly the different steps in its construction. Besides, the band itself is too small to convey a clear conception; nor will such methods of instruction give an idea of the proportions of the different parts, nor how they are put together. If a finished crown is exhibited to a student, that gives little knowledge of the method of its construction. It is necessary to show all the different parts. Yet it is not convenient to do this at times, nor are they sufficiently large to give that clear conception which is necessary to a complete comprehension. Besides, some teachers lack that ready flow of language, that copious vocabulary of words that enables them to give a graphic idea of any mechanical construction simply to the sense of hearing. Then, too, some students do not easily and readily comprehend the fine shades of distinction upon which all real artistic results must depend.

The use of blackboard illustrations in instruction supplements the other methods, and in many cases becomes of the first importance in conveying information. There are certain advantages possessed by him who can make a clear drawing of an object that will enable him to impress himself upon students more deeply than the most eloquent lecturer. For instance, different parts in the construction of any appliance before they shall have been united may be graphically placed upon the board, and their proportions pointed out. Then a drawing illustrates the union of the first two; then the addition of more, until finally the completed object is presented to the eye.

To convey the proper idea it is sometimes necessary to exaggerate a particular part. The real, true proportions would not properly illustrate the lesson which it is desired to impart. For instance, it is desired to point out to students the difference between the typical teeth found in the lymphatic and in the nervous temperaments. This, while plainly enough perceptible to the eye in nature, would be comparatively unmarked in a model which was the exact duplicate of the teeth themselves. To convey an impression of the difference it is necessary to exaggerate each peculiarity. This may be readily expressed upon the board.

Common defects very minute in themselves would not be made plain to the average observer in the object itself, but when a drawing of it is made and this defect exaggerated somewhat it is clearly conceived and guarded against.

There is one peculiarity in blackboard instruction which should always be borne in mind, and that is that the illustration always presents a flat surface. By showing the perspective it may be possible to give an idea of stereoscopic effects, but the picture is always a flat one. While this presents certain disadvantages, on the other hand it enables one to illustrate more perfectly an object by drawing upon a board a number of flat surfaces which, when joined together, will produce the completed object.

For instance, drawings will not at the same time present perfectly the labial and lingual sides of an incisor tooth, which a model may do, but the drawing of the labial side, when made, will more perfectly exhibit any special peculiarities through a little exaggeration of them than can any possible model. Then another drawing must be made of the lingual side, for the purpose of pointing out peculiarities on that. This necessitates two presentations, while the carved model requires but one; but each of these two, to the teacher who has the ability to draw clearly, is worth a great many models for the purpose of giving instruction.

Blackboard illustrations should always be combined with oral teaching to a certain extent. It is absolutely essential that the teacher should explain what he is doing in words which will convey his ideas. Blackboard illustrations can never be depended upon alone. They are imperfect by themselves, and require the lecture to accompany them for their full comprehension. Hence the blackboard is not a primary method of education, but it is an adjunct which supplies that which is lacking in verbal instruction.

In all forms of didactic teaching it is of the very greatest use. As I have already said, words cannot give an idea of morphology. The chalk very readily does this; but while the blackboard illustrates form, it cannot perfectly describe it. Hence the lecture and the blackboard should always be combined, and always go together. That didactic teacher who is not more or less an expert in drawing is to that extent unfitted for his position. If he is able graphically to place before his class an illustration of his idea he will impress his lesson a hundred times more deeply upon their minds, and the perfection of the teaching will very largely depend upon the perfection of the drawing, just as perfection in lecturing depends upon the command of the proper language on the part of the lecturer.

The teacher should endeavor to address himself to as many of the senses as possible. In technic instruction this is of the highest importance. Sometimes even taste and smell are required to give a clear idea of some particular object; especially is this true in teaching materia medica. It is the odor and taste which enable one to identify certain drugs, rather than their appearance or description. But, as I have already said, it is chiefly to the senses of hearing and seeing that the instructor must address himself. The ear has no conception of form or proportion, nor is it possible to convey a clear idea of morphology by words alone. This absolutely requires the sense of sight. On the other hand, the principles, and rules, and laws which govern the construction and use of appliances cannot be conveyed through the eye. They must be addressed to the ear. Practically, then, the technic teacher is required to convey his information through the two senses of sight and hearing. I have already shown that in some instances one of these is the more important, and in some the other; that neither can be dispensed with; that a perfect idea of any appliance cannot be obtained through one sense alone, and that the judicious and sensible teacher will group together the senses and address himself to any one of them which he can conveniently reach. If one would train himself for a successful teacher he must develop his capabilities in all of these directions. If he depends solely upon words, though he possess the eloquence of a Demosthenes, he will not make a successful teacher. If, on the other hand, he depends solely on the sense of sight in his pupils, while they may have a clear idea of the form and construction of an appliance, they can have no conception of its use. They cannot understand the rules and laws which govern its construction and its employment.

A knowledge of drawing is as essential to a teacher of technics as is language. The chalk in his fingers will speak louder than the words upon his tongue. If he is deficient in either of these methods of communicating information, just to that extent is he crippled in his vocation. If it is necessary that he should study physics and mechanical laws, it is just as essential that he should study drawing. He may not be a finished artist and he may not be a trained elocutionist, but he should know enough of both of these to be able to convey his idea through either the chalk in his fingers or the words upon his lips. Neither of these alone is sufficient, but both are essential. There are some objects concerning which one may speak for an hour without any ability to convey a clear, definite idea, when, with the chalk in his fingers, a few strokes are sufficient to express more than words can convey.

Dr. GRITMAN, before reading his paper, proceeded to show by blackboard drawings the method adopted by him in using chalk of different colors to illustrate the ideas he wished to convey.

DISCUSSION.

Dr. H. W. ARTHUR. What I have to say is what has come to me while listening to the essayist. The subject of the use of the blackboard, or in regard to the advantage of the blackboard, is one I indorse very fully, and in my limited experience I have found it exceedingly valuable. Some men have an idea that they must be artists in order to make use of the blackboard, and I think for that reason they do not probably use it as much as they should. I think we can use the blackboard to great advantage by preparing something before we go to the class. Where we have a double blackboard, we can thus anticipate the work by making the drawings beforehand, and then call the attention of the students to the point we want to draw out, and use the chalk in that way, rather than making the whole drawing before the class.

There is no question about it, no matter how clearly we express a thing in English, we do not convey the impression that we would by a drawing. We all know that. My own experience has been in going among a class after I thought I had presented the subject very clearly, and there could be no misunderstanding, I would find few who had a full comprehension of what I wanted to convey; but by the use of the board I find I have been able to convey accurately and clearly the impressions I wish to, so it would be understood.

What I have to say would be more in the line of the way I have used the blackboard. For instance, in taking up the study of form. And first the teacher ought to show that he can do what he asks them to do. So, if we are drawing, we ought to be able to show the students we can do what we ask them to do. If we want them to carve a tooth, we ought to be able to show them that we can do it. Some students may not be able to perfect and make any and all the details of the tooth, yet they can bring out the form with sufficient perfection so that we know that they know the form of the tooth. In carving the teeth, the first thing I have them do is to make exact measurements, taking Black's "Anatomy" as a guide. Then, taking a block, I have them, with these measurements, cut out the shape. We call it "blocking out the teeth." Then they mark the outline—just a general one—of the tooth with sharp instruments.

In regard to dissecting teeth, you want to tell them how you would begin to cut the tooth. If you tell them to take a half-round file and cut just below the cervical portion, probably they will take the edge of the file and cut across the pulp-chamber or canal; but if you tell them you want to approach at that point, and show them just where you want them to cut, they will approach it right.

Then, in the matter of teaching the proportions of cavities, it just occurs to me if you want to show where the undercut should be in the dentin, it can be of great advantage. And in all these ways the chalk can be made to serve a great deal better purpose than any drawings that we may have, because we can modify it, rub out, and add; whereas we don't want to mar or destroy a drawing. For instance, we take a typical tooth, a cuspid. If we want to show how the other teeth are combinations or modifications of this, we can show, for instance, that the lateral incisor simply by removing the cusp that way we have more or less the form of the central incisor, and by combining the two cuspids we can readily see how the combination of the two cusps will make a bicuspid. In that way we can convey with a blackboard a great deal more readily than by oral expression. That is the way I have been accustomed to use it. I am sorry I am not better able to present what I have to say. That is my apology for not making it more clear to you.

Dr. N. S. Hoff. There is a method of using the blackboard that I have heard of but never used myself. It is used in the old country by those who teach histology; but, instead of using the blackboard, they use ground glass, and place underneath it the outline or form, to which they make additions with crayon on the ground glass. It has occurred to me that if our teachers in orthodontia had some such method they could have behind the glass a set of teeth upon which could be put all sorts of appliances. It is very difficult to convey to students just how to adapt these appliances in the mouth for regulating purposes, and I wonder that some one has not adopted this method.

Dr. L. S. TENNEY. I have listened to the fundamental principles of teaching that have been so admirably presented by Dr. Webster, and we have had this very able paper in which the practical side has been presented to us. The longer I am engaged in teaching, the more thoroughly I am impressed with the idea that it is absolutely impossible to teach by didactic instruction only, and the more we can be assisted by models and illustrative work of this character the better success we shall have. It seems to me to be absolutely necessary that we should appeal as well to the sense of touch as of hearing. I have often wished that I was a crayon artist, and often thought that I would take lessons. We see here what a vast advantage it is to utilize this method of presenting a subject. I feel that it has been a very valuable session, and I want to compliment both the essayists on their papers.

Dr. W. H. WHITSLAR. I want to illustrate a point that the essayist suggested in his paper, that sometimes a very few strokes may illustrate a very important lesson.

(The speaker then showed by drawings the effect upon the expression of the face caused by the loss of the teeth, showing different expressions of the mouth following the loss of different teeth.)

Dr. BARRETT. An idea of form can only be conveyed by sight; hence the teacher who depends wholly on verbal or oral instruction cannot give to the students that which he should. Further, the object itself does not do it. First you have the parts, then you have the parts united. For instance, I place on the board these two lines; it conveys nothing especial, nothing that gives any idea of what it is going to be. I add another line, and you have at once a full idea of what I wish to present (illustrating on board). Hence in my own work, where the blackboard is of as little use as it could be in any branch of teaching, yet I use it a great deal. If I had skill in drawing I would be a much better teacher than I am, but with my crude ideas of drawing, with chalk in my hand, I can often present an idea very fully and bring out what I desire to present.

Dr. G. H. WILSON. I want to emphasize the idea that has been brought out by the last speaker, that it is not always necessary to have an elaborate idea of drawing in order to use the blackboard acceptably, because many times the crudest drawing will bring out an idea very nicely. For instance, if we wish to illustrate the regulation of the teeth, the student would not see the idea so clearly if we drew a perfect tooth; for with a bicuspid we have a triangular form representing the several surfaces coming together, and we show to the student that the force is always applied at right angles to the surface from which it is required, so that by drawing straight lines we make the triangle, and we can show how the force should be applied. We can do that better with the crudest drawing than with an ideal form of the tooth. Any of us can draw simple forms, and it is a wonderful assistance in teaching.

Dr. JAS. TRUMAN. I wish simply to indorse the idea of the blackboard. It is some thirty years or more, I think, since I abandoned the use of preparing drawings, sketches, etc., to give to a class, for the reason that I would not care to present a written paper or lecture. I would not desire to bring up every year these old drawings, which the class gets perfectly tired of looking at and to which they pay no attention. If you draw upon a blackboard all that you desire to illustrate, either before the lecture or during the lecture,—but I prefer doing it always before,—you then have something that attracts attention at once, even though it may not be very artistic. I am inclined to think that methods of didactic teaching without the use of the blackboard at all are almost practically worthless. We must, as has been stated, attract the student's eye as well as his hearing, and I think it is more important to attract the eye. Now, of course, none of us can be considered artists in drawing, but I think every man with a little practice, if he is a teacher anxious and ambitious to be something, can readily acquire sufficient tact and knack to draw on the blackboard. As far as I am concerned, some lessons I had in drawing when I was quite young have served me a good purpose. Although it never made me an artist, it aided me materially in my work. I am sure every teacher ought to endeavor to do something in that line. In fact, I think drawing on the blackboard with colored chalks is more satisfactory than lantern exhibits. I have seen both and used both, but I prefer the use of the blackboard under certain conditions.

Dr. C. S. Case. This is a subject which strikes me as one of the most important things in teaching. The first thought that occurs to me is that a man should know and see in his own mind what he wants to produce. If it is a tooth, he should know the anatomy of the tooth thoroughly, and should be able to see that tooth in his own mind; it should stand out as distinctly before him as if he were looking at the tooth itself. Then he can turn it to any attitude and put the picture of it on the board, and that is all there is of it. When he can do that he is able to teach, and if he cannot do that, if he has got to draw from some stereotyped picture that he has seen, it strikes me that he is not making the best use of the blackboard or the blackboard method. Now, that has reference not only to the teeth, but to everything else. Some men are more fortunate along this line than others. I have been very fortunate in that way, and have been able to reproduce almost everything I desired, and I have found it to be one of the greatest aids in teaching. If we would talk less and show more, we would make a greater impression on our students.

Dr. S. H. Guilford. It seems to me that every teacher ought to avail himself of the various methods of teaching, whatever they may be. That is to say, we don't want to teach in a stereotyped way, and whenever illustration will aid us in any way, use it. It can be done in various ways, either by diagrams prepared or very elaborate and correct illustrations, or we can use the blackboard. We cannot convey ideas by words only; we must utilize the eye as well. In my own work I have some very elaborate drawings, anatomically correct and beautifully done, and I hang them on the wall and lecture from them. At other times I go before the class and make the drawings on the board, and I know they are very much more effective. I never knew a student to copy a ready-made drawing into a note-book, but frequently have seen drawings in the note-books.

There is another point, suggested by what Dr. Barrett said, as to making a couple of strokes to bring out what you otherwise could not do. In making a drawing, if you can associate with that some other geometrical figure or form it will be better.

What Dr. Truman said is very true, about students becoming familiar with the same figures brought before them from time to time, and they tire of them and pay no attention to them whatever.

But we should not do too much of it. As soon as the teacher's back is turned to the class, there is bedlam in the other end of the room. With the chalk in hand, never lose attention. Do a little at a time, and watch the class all the time.

Subject passed.

Adjourned to meet at Dental Hall at 6 P.M., to inspect the University of Pennsylvania and partake of a luncheon served by the Dental Faculty. After the luncheon, the president called the meeting to order in the amphitheater of Dental Hall, and requested Dr. E. C. Kirk to introduce the speaker of the evening.

MANUAL TRAINING.

Dr. E. C. Kirk. I think there is no department of our work which is more important and which will excite more interest than the subject of manual training as a means of mental qualification. We have not been pioneers in this matter. The manual training idea in general education is, as you all know, a topic or line of pedagogics which has been pretty carefully worked up. Some years ago it was my good fortune in an investigation of this subject to come in contact with a gentleman who was an enthusiast in this training. He was not only an enthusiast in general terms, but a man who exemplified in his own life the results of a proper system of manual training. I therefore take great pleasure in introducing to this audience Professor J. Liberty Tadd, of Philadelphia, who has, I think, done more than any other one man to popularize this system of education.

Professor J. Liberty Tadd. Mr. Chairman, it gives me great pleasure to speak to you on the subject of manual training in education, because I consider it of more importance than any other subject that can engage our attention, since it teaches the physical being, the mental being, and the spiritual being. Is there any work in the world comparable to the unfolding and expanding of a human mind? Teachers are builders of the city not made by hands, every stone of which is a living human soul intrusted to their care to shape or mar.

I am to speak to you on the subject of manual training; by that I do not mean just the hand, but mental training. We think with the brain, but we act with the hand. We must make the one the good, obedient servant of the other. Some one has said the hand is a projected brain, by which we direct the thought and achieve the heart purposes of man. The hand is the projected brain through which are directed the thought achievements of the heart purposes of man. I have to make a plea to-night for the development of the hand and the eye, two of the capacities which are very greatly neglected in all the schools. I am to show you a method of work that is quite radically different from that carried on in other schools, except the one established by and sprung from the Industrial Art School. Aristotle said the hand is the instrument of the mind. It is the instrument of instruments. It is the key whereby are unlocked the potentialities of the being, and if we are to do anything for the young surely we are to give them a chance to grow into power instead of out of it. One of the saddest things in my experience is the fact that parents bring their children to me all the time unable to do anything. The hand is allowed to grow up and become adult before it is allowed to do anything. The same with the sense of sight. Some of the other capacities are cultivated up to a certain amount of training and discipline, but the sense of sight is allowed to go on as best it may. Nay, in some of the schools we actually injure sight. We shorten it, and a great deal of the joy and pleasure and usefulness is thus left out of life by neglecting the sense of sight or vision. It is the united action of the eye and mind that gives accurate observation and keen perception, sound reason and energetic action.

In a paper read by Dr. Kirk a few years ago this statement was made, which is one of the classics in manual training. He says, "The development of the mind is a natural physiological process exhibiting two phases, one of which is the acquisition of ideas through the perceptive faculties, and the other the practical arrangement of and reasoning from these acquired ideas." I might add another, which is the amount of executive volition that is generated, volition self-generated, and that is the thing we endeavor to do. Nothing is of more importance to the young than the possession of a physical being capable of making refined, delicate, accurate movements, which minister in so many ways to the welfare of the organism. Nothing is of more importance than the possession of a mental fabric built up by accurate observation, filled with clear, lucid, perceptive ideas, the result of the skillful, delicate movements. Nothing is of more importance than the possession of a spirit capable of giving an energetic impulse to the body and mind in the direction of the right and necessary. This threefold object of the work is what I wish to explain to you. It is not the subject of manual training alone. It is something more; much more. If we are to do anything for the young in educating them, we are to give them a chance to get the joy and beauty that is blended in nature, as deep and high and broad as space. To give them a chance to enter into the heart and voice of the Almighty, speaking to them from common things of nature, things of which we see so much and know so little, before they are thrust into the grooves of business, which too often become mere ruts.

I have spoken to you of the work we are carrying on in the public Industrial Art School, an institution where I have been experimenting for over twenty years. I fortunately have been allowed to do what I pleased, and nearly the whole of the time I have been performing experiments, and I have come now to some settled facts, which I want to show you. At the beginning we tried many kinds of manual training, wood work, clay work, metal work, and a number of minor points. We have settled down to four fundamental things that I shall show to you. The entire object has been to get something that will give skill to the hand, fundamental skill; to give accurate observation, and, at the same time, through the hand to build up that fabric of ideas. The object is not only skill of the hands, but through the hand we develop the brain centers, and we actually fabricate ideas. I am accustomed to say that the hand is rooted in the mind. The work differs entirely from the work carried on in any of the schools where they have mechanical training, practicing carpenter work and various kinds of like studies. We study for the practical development of the entire organism, the hand, the eye, the mind, performing certain exercises for getting certain ends. The school offers exercises in various mediums; for some purposes soft clay and tough wood. For the purpose of gaining skill in shaping various things, we offer plants, flowers, shells, fruits, birds, etc., during the nascent period when children are most fascinated with nature forms. If we don't take them at that period they never become interested, and do not get the mental images that are so desirable. If we take them at the period when they are fascinated with natural forms, we get a different mental fabric. I will prove that the whole is a work of thought expression, just as speech is a mode of thought expression, as writing is a mode of thought expression, and as is music. If we study these methods we get ideas that will help us in our work. For instance, we know children learn to speak by making simple sounds, and then by the almighty force of habit; by repetition they made those sounds automatically, and from these sounds they made words, and the words form sentences. We do not say that we have fluency in speech until we can give the entire attention to the idea which we wish to convey. And so in writing, you may remember how difficult it was to first make the rotary movements, the shaping of the lines. By practice, by repetition, by the almighty force of habit we gradually become able to make these forms, and then group them, forming words; and from these we make sentences. And we do not say we have the facility in writing ideas until we can give the entire attention to the idea we wish to convey, instead of to the shaping of the letters. So it is with music. Some of us can remember how difficult it was to make the first motor movements on the piano or violin, but by practice we become able to do it first with one hand, then with the other, and then both together. All the study in the world, all the genius in the world, will not enable me to perform the simplest piece unless by repetition I build into my mind these motor movements, so that I do not have to give thought to the position of my fingers. And the more frequent discharge of energy there is back and forth from the nerve-ends to that center of the brain tract directing that movement, the better I can perform it. So it is with all our work.

There are different kinds of expression in material, just as different kinds of expression in drawing. You know there are many kinds of architecture, machinery, object drawing, and so on. There are different modes of expression in wood, clay, iron, stone, etc., but all hand workers agree that there are certain fundamental principles. What are they? First, facility of the hand. No one disputes the fact that this is desirable in manual training. We make that automatic. Now I will point out where we are different from all other schools, from the fact that we make many of these things automatically with perfect facility from the start. Another thing is the power to make things stand erect; to feel horizontal lines or vertical lines. Then another thing is to be able to feel balances; an automatic power to feel one side equal to the other; to be able to feel fitness; to be able to grasp magnitudes. The moment we can feel proportion and grasp it through the hand instantly, automatically, we have power. That is the fundamental principle of the work I shall explain. Let me illustrate. I shall use the simplest marks we have in the kindergarten, and I shall show you a class room with the children at this work.

I am going to make a circle (stepping to the blackboard and illustrating). It is the first time I have done it, and you notice my hand shakes. I am a little nervous, you see, but by practice, by repetition, I get so I can swing my hand without any trembling. Of course I am speaking of children five or six years old. By practice, by swinging the hand continually, we gradually get power to make that movement with facility. The same with the left hand (illustrating). At first it will be difficult, but by practice we get so that we can swing the hand freely; and then with both hands (illustrating); then reversing; then to the right; then to the left, each one of the movements being a new physical co-ordination. We never give more than five minutes at a time, but we make every possible physical co-ordination that is possible on a flat surface.

This is another one (all these remarks are accompanied with illustrations), a little more difficult you see, making hand go in different directions. We have large classes in the feeble-minded institution at Media. We found they could do this work of co-ordination, and beautiful work is the result. In a very few seconds, never more than three or four seconds, almost any co-ordination can be made. Let me show you straight lines. I shall scribble because I want to show you so much. Each form is made with both hands. For instance, I am making this; by repetition I become able to swing my hands freely, no trembling at all. It is done automatically; that is what we aim for. We don't seek for accuracy; we seek facility, and then accuracy. In doing this I am gradually becoming able to feel form and movement, until I get perfect dexterity. I shall not make each form, because I want to show you so much. Each one we make in all directions, and get every possible movement on a flat surface; and the same thing in soft clay, and the same in tough wood. We have many of these forms that we make in various directions. Now, very quick, I wish to show you some of these forms, based on the thought that they are made automatically. I am purposely drawing these very rapidly to show that they are made automatically. Of course, if I took a little more time I could make them better. Now you see the range. We take any design and make it automatically first, and then see the range of possibilities. Every one gets the power to make the same thing in soft clay, and then in tough wood; and you can see at once the co-ordination; not only on the flat surface but in soft clay and tough wood. If I take up this chisel I am required to be able to cut right and left; the same with this gauge. I must be able to push or pull on both sides; the same with the mallet. You never heard of an engraver using one hand. All sculptors work with both hands. We must feel the wood through the chisel, if it is two feet long or three feet, just as if I was touching it with my finger; actually drawing in wood as we draw on the blackboard, just as we draw in clay and wood. Wood has a certain amount of texture which resists in some places, as the grain goes across or straight. We have to work four ways in going around a circle in carving. I am speaking now of carving, because I consider it of such great value to be able to cut out form by thinking form; to be able to project the thought and then cut out the form in the wood. In this way I can measure force. I can put here a pressure of fifty pounds by pushing with this and holding back with the other. These movements are especially appropriate for manual skill in a certain amount of physical co-ordination. With these exercises we have this automatic power to be able to grasp form in any medium, in wood, clay, ivory, or metal; to be able to feel form. There is always one point of the circle where the hand will find it a little more difficult. In making that I have made a double curve all around the circle edge. I have the power to go off and make the greatest variety of forms. You can see at once it is automatic. This time it is more complex. I begrudge the time of these diagrams because I want to show some of the children at work, but I can go up to the most elaborate forms that are used in art, each form being drawn free-hand and made automatically. With the children in this work we have three mediums, the blackboard or paper, then in soft clay, and then in tough wood. The children are compelled to remember and recollect the images. We don't care how crude they are, but we get wonderful results.

I shall show one or two of the boys' work before I show anything else. These are boys from the Catholic High School. I have charge of the public Industrial Art School, where we take care of ten hundred and sixty children. Each week they receive two hours. My endeavor has been to get the greatest amount of manual training possible for the large number. (Three boys about sixteen years of age were sent to the blackboard and told to draw what they wished.) Notice that the movements are automatic; the boys can do the same thing in clay or wood. I want them to hasten, because my time is limited. Now, remember, these boys can think form of any kind, and they can draw all day long and the pattern will be different. Of course they will draw other forms, geometric, or constructive, or natural forms. These forms show a certain amount of balance and proportion, and you see the endless variety that can be made. Most people in drawing must keep a piece of rubber in one hand and rub out half they do. Our children think form; not only form on a flat surface, but also in tough wood or soft clay. I want you to get the idea that we have automatic power in this work; that they don't have to give attention to the movement of the hands. The forms they are making are simply projected ideas.

Some people might say these forms are not correct. The Greeks were the greatest draughtsmen of whom we have any knowledge, and they never made a correct form. They never made two sides of one pattern absolutely alike. There was always enough difference to show that it was hand-made. These boys have worked four or five years, and are through the high school now. We are working a little too quickly, because I want to show you so much and have so little time.

Now I shall show you some of the drill forms. Understand, we give these forms to small children. It is better than a great deal of the kindergarten work carried on, because it makes use of the free-hand, arm, and spine movement. There is a great deal of wrong in the kindergarten system, because they use the fine centers too soon. They do paper cutting and stick pins in holes, etc. I believe in the spirit, but not in the act of kindergarten teaching. We have lots of children that make perfect circles, swinging the hands one way, and then the other. How do we get nature forms? How do we get natural forms? Let me illustrate. I have a large class of children, and I say to them,—we take one or two hundred at a time,—and I say let us draw a horse or a man. Some say they can't make a straight line. If I ask a lot of children to draw a man, they make something that gives the idea of a figure. If I ask them to make an animal, they make perhaps a body and tail and four legs. We can't tell what kind of an animal it is, but it gives an idea. If you have ever made a diagram of anything, no matter how crude, you can hardly forget it. The point I want to make is that in making these things we use the muscular sense, and we lock the idea in the mind permanently. Now I am going to make a very rough diagram. I am thinking a bird with a long neck; here I am thinking a bird with a short neck, and here I am simply putting down certain mind impressions. The same if I think any other form. No one can draw and delineate a simple form without making a more vivid impression. We help the mental faculties; we do fabricate ideas.

There is nothing of more importance in education than a power to get accurate observation and keen perception, sound reason and energetic action. It comes through these three modes of work, and I claim there is nothing will energize the organism more than doing this work. While getting power to discharge energy through the nerve-ends by these movements, we energize the centers of the brain. It is during the period of youth that we must do this if we wish to get good results; this superabundant energy that children are so filled with that must be directed in these channels. It is thrown away now and wasted in many cases. Too often in the schools we consider printed, written, and spoken words instead of real things. I would make a plea for more time to be taken from book studies and given to the realities. I have a shell in my pocket, a stone, a flower; anything would do, form, color, etc. It is bristling with ideas; it is teeming with facts. Is it unreasonable to expect that the pupils that are getting an education should become able to focalize these facts? I claim we should get them so they can instantly respond to any natural form. I ought to be able to give fifty under each head, and then all the abstract facts. That is not unreasonable, and in doing this work we do get mental fabric. That is quite different from that where they assimilate only printed, written, and spoken words. Every natural object teems with something that is wonderful in form, color, texture, and the study of them creates expansion of physical knowledge, mental knowledge, and spiritual knowledge. If God speaks at all,—and who doubts that he does?—he speaks through his works. Morrison says we are to bend to the persuasion that is flowing to us from every natural thing. Shakespeare says there are

> "Books in running brooks, sermons in stones,
> And good in everything."

Now I shall show the boys again drawing some natural forms, and then I want to show the work on the screen. These boys will not only make one form, but will make it in any position. You know a great deal of time is lost in school by memorizing. We use this work in all the studies, anatomy, botany, geology, zoology, and we lock the facts into the mind through the sense of touch. In one case energy is consumed, in the other it is conserved. Of course, you can see these boys are feeling a certain amount of form. Some one has said that genius is the power of co-relating innumerable memories. These diagrams illustrate how we get the technical names. By means of diagrams we lock the ideas in the mind. I make a diagram of a fish and put the technical names to it, and it is retained in the memory; for we use the sense of touch, and then we make an impression that is permanent and abiding.

(Lantern slides were then exhibited, showing the interior of different school rooms and the work done by the students in the different institutions.)

At the close of the address it was moved that a vote of thanks be extended to the lecturer for his most interesting and instructive lecture.

Dr. E. C. KIRK. I feel there is no time at our disposal to discuss this matter, but I wish to say a word, to raise this thought in the minds of those present, if it has not already occurred, and that is the significance of this course of preliminary training as one suitable for the students preparing to enter upon dental studies. It seems to me if our students could receive a course in manual training, we would have a much more satisfactory foundation upon which to build the superstructure of dental education.

A MEMBER. Is it feasible for adults to attempt work of this kind? Is it not designed to begin with children rather than at adult life? Do adults ever attain any great degree of proficiency?

Professor TADD. Of course physical co-ordinations and mental co-ordinations can be made better in youth, but I find people of sixty years of age can do this. We have plenty of them. We have large classes of public school teachers. Of course, it is more difficult to make a man learn writing at forty years of age, but he can always become able to write; so I claim I can make a man of forty or sixty do this work. This does not require genius; we make capacity by the repetition of certain deeds. We have feeble-minded people who do this work. Sometimes pupils who have the least power in the beginning do the best; those who start very brilliantly sometimes do not equal the others.

I especially feel it is desirable for dentists, doctors, and surgeons, because it teaches ambidexterity. I have taken graduates from some of the greatest institutions of this country, Stevens Institute of Technology, the Boston School of Technology, and others. I have found that they have a certain amount of power in certain directions, but they do not have manual skill as I mean it. They don't have this automatic power to feel form, to recollect and revive mental images. That is what we claim is most valuable, to memorize and feel form. I have suffered at the hands of dentists; not in this country, but in Canada. I had a man chisel in a cavity, he called it; it was really a cave or cavern in one of my teeth. He would push and could not inhibit. You know what that means. He could not inhibit his touch. He would jab the drill into my gum very frequently. I felt that that man did not have manual training. He needed a certain amount of power to retard his touch, to feel form. By working in these three forms we get that power in a remarkable degree.

Dr. W. C. Barrett. It is necessary for the dentist to have his hand educated as well as his head, but life is too short for the higher education. We want fifteen years for educating the brain and fifteen years for educating the hand, and where would you draw the line between the two, as to which shall not overlap the other; what is the most appropriate point at which to stop the education of the brain and the education of the hand? That is the practical point that comes home to us.

THE USE OF THE LANTERN IN TEACHING.

Dr. M. H. Cryer, of Philadelphia, gave a lecture on this subject, using the lantern and projecting microscope.

Dr. Cryer maintained that the projecting lantern with good photographic slides furnished a mode of lecture illustration second only in value to demonstrations upon models or actual cases. The use of models, charts, etc., was of less value in that these modes of illustration could not be satisfactorily used for large classes, whereas a photograph projected upon the screen was visible to all at the same moment.

Professor Stellwagen was among the first dental teachers in Philadelphia to use the lantern, and in histological work especially he advocated the projecting microscope, using the actual section of tissue rather than a photograph to avoid photographic errors and secure a picture on the screen giving the elements of the tissue in the normal colors of the stained specimen. Until recently a satisfactory projecting apparatus for microscopical sections has not been available, but we now have an improved apparatus which gives thoroughly good results, as will be demonstrated.

A well selected and properly arranged set of slides makes the most satisfactory lecture notes available, relieving the teacher from the burden of preparing a written discourse or copious notes.

Further development of projecting apparatus should in the future enable us to throw upon the screen images of operations in progress and of solid objects without previously photographing them. The biograph or some modification of it will undoubtedly be brought into requisition for lecture illustration when the defects of the present apparatus have been eliminated and its cost reduced. While the electric arc light is the best illuminant and the cheapest at our disposal, the varieties of apparatus and illuminants are so considerable that any teaching institution, whether equipped with electric current or not, may now secure satisfactory projecting apparatus well adapted for the purpose.

The use of many pictures should be avoided. They should be introduced to illustrate the points upon which instruction is given, and not be shown as an exhibition of pictures to supply the lack of brains or teaching ability upon the part of the lecturer.

A collection of slides made from the several dental schools of Philadelphia was then thrown upon the screen. They covered the whole range of subjects included in the dental curriculum.

Dr. F. D. WEISSE. I am very glad to be present at this exhibition. I commenced using the lantern for lecturing twenty-five years ago, and I have been using it ever since. I have preached the value of the lantern ever since that time, and it gives me great pleasure to see and listen to this demonstration of the possibilities of the lantern as a means of showing to large classes what we have to do. I think those of us who attended college twenty-five or thirty years ago remember well how a skull was passed around, as Dr. Cryer describes; and the professor would go around the three sections, right, and left, and middle.

There is no department of education where the lantern cannot be made useful. As Dr. Cryer says, there is no department of medicine, dental or general medicine; there is no department of learning in which the lantern cannot be used to the greatest possible advantage. No educational institution is properly equipped that is not supplied with the facilities of lantern illustration. They can be easily kept, and the slides are cheap, sixty cents each.

In my early experience I used an oxyhydrogen light for years. Afterward I had a battery made strong enough to use electric light. That was before we had electricity as it is used to-day. For the last six or seven years we have been using the double electric arc light, and we find it perfection.

Another point in using the lantern. I have found it most satisfactory not to give them too many pictures at one time. I never allow more than one picture at a time to be exhibited to a class. Describe that thoroughly, and then pass on to the next; that is, in using pictures or cards. This idea we get to perfection with the lantern. I think no one can as effectually communicate his ideas without illustrations as he can with them, and the lantern is a very valuable means of making these illustrations.

ORTHOPEDIC TECHNICS.

By C. S. CASE, M.D., D.D.S., Chicago, Ill.

(Before commencing to read the paper, Dr. Case passed around among those present a card to which were attached different specimens of bands and wires, to which he referred in his address.)

In accepting the invitation to present at this meeting a syllabus for the teaching of technics in orthodontia, permit me to say at the outset that I do so with no ambition to exploit personal ideas or advocate any one man's system of practice, but rather with the hope that we may unite in our efforts to upbuild this department and make it a worthy branch of a noble profession.

To accomplish this most effectually it is important that we unite upon some common ground of understanding as to its importance, its possibilities, and its needs. With this as a foundation it will not be difficult to construct a syllabus that will be mutually acceptable and advantageous to all who desire that this branch shall be taught in the most practical and sufficiently thorough manner.

Whatever the seeming differences in *modus operandi* among advanced teachers of orthopedic dentistry, I believe the general trend is toward scientific principles and practice, with the gradual elimination of methods that have encumbered the advancement of this department in the past.

I believe it is quite generally accepted and taught that teeth can be slowly and safely moved under limited conditions of age and healthfulness to relatively new and permanent positions, and that such movement is susceptible of being accomplished exactly in accord with mechanical application of force and in keeping with its action when applied to other things in mechanics. Further, that force can be so applied to the teeth under favoring conditions that the roots and adjoining alveolar process will be carried bodily in the direction of its movement, even to influencing to a limited extent the development and future shape of the maxillæ.

Moreover, I believe the statement will not be controverted that the esthetic phase of the operation of dental regulation is, with rare exceptions, by far the most important part of the undertaking; and that this beautifying effect is not confined to the appearance of the teeth alone when exposed, but may be made to extend its influence to all that area of the physiognomy which is dependent for its contour upon the teeth and bones that are susceptible of being changed in their relative positions and shape by orthopedic processes.

These facts, with their broadening influence, increasing the field of our accomplishments and future possibilities in this department, bring us as teachers properly to the consideration of the question, Has the science of regulating teeth attained a stable position of sufficient importance to the profession of dentistry to induce this body to co-operate in teaching it as other branches of dentistry are taught, with a thoroughness in every detail that conserves to the highest accomplishments of the art?

In attempting to give in detail the course which I endeavor to teach in the purely technic branch of this department, I fear I shall encounter many objectors to its extent, etc., who believe that the difficulties to be encountered in what they are pleased to term the simple regulation of teeth do not warrant the occupation of so much time for training students in the mechanical construction of implements, stock material, and appliances, which can as well be purchased, etc.; while others will claim that I go into the work too deeply, or pursue a course which students cannot successfully follow,—that there are other ways much more simple, etc.

I know one dentist who accomplishes pleasing results in the regulation of teeth with silk ligatures alone; another with thin ribbons of pure gold; others with rubber plates, etc.; but that does not deter me from believing their accomplishments are quite limited when compared to those of more thorough methods, founded upon scientific principles.

In my opinion there is no royal road to the highest success in this or any other department of dentistry. And, while I do not assume that we have more than begun to approach the highest success of this department, or that I am more successful in my efforts than others who with me are earnestly striving for its greatest attainments, and whose methods may differ decidedly from mine, I can but strive for the teaching of those principles which experience has taught me will accomplish the results aimed at in the most perfect and efficient manner.

My practice and teaching in the technic branch of the work is founded upon the principle of applying force, almost exclusively, through the medium of attachments soldered to bands fitted and cemented to the crowns of teeth.

While there are many other ways by which the most satisfactory results have been attained, and which I am not here to criticise, I believe there is no other way that will afford the same opportunities for applying force for the movement of a tooth, on the one hand, in every conceivable direction, and on the other for the non-movement of teeth grasped by stationary anchorages and retaining appliances, to say nothing of many other advantages which it and the system dependent upon it affords.

The reason I here lay so much stress upon the band is because upon it, in its completest sense, depends the very character of principles I attempt to teach, which is no man's specialized system, to be followed by rote, but in my opinion a foundation almost limitless in its possibilities for the development of individual ingenuity, —that keynote to successful practice in this department. While the principle of banding teeth is not new, I contend that it is not commonly taught or practiced in a manner to obtain its fullest usefulness. I therefore feel called upon to make a plea for the band to start with, with the hope that we may agree upon this as a common ground to shape the character of our orthopedic technics. In the same way that you as a body of teachers, after deciding upon gold as the only filling-material for certain cavities, because you see in it certain results that cannot be attained in a like degree with anything else, you proceed in your methods of teaching to thoroughly develop every principle in consonance with its use,—principles, moreover, that have originated through the medium of its possibilities.

I do not mean by "bands" any thin, narrow ribbon or bands of variable quality and adaptability that may be cemented to the crowns of the teeth. And certainly not those that are looped around and uncemented to one or more teeth, nor those that are supplied with attachments, however ingenious, intended for the purpose of avoiding proper fitting and soldering, those saddest of commentaries upon the inability of dentists to perform one of the simplest operations; but I mean bands that possess the special qualifications—properties, thickness, width, position, etc.—to meet the demands of the particular force that is to be applied.

I have found no other material that combines so many of the desirable properties as high-grade German silver for every part of a dental regulating apparatus, with an occasional exception. German silver, as you know, is an alloy of copper and zinc, or brass, with the addition of nickel. Some manufacturers add a small percentage of aluminum and iron.

It is difficult, if not impossible, to obtain German silver from a dealer that is fit for immediate use in the construction of a regulating appliance. Manufacturers do not supply to the trade German silver wire above eighteen per cent. (which means eighteen per cent. nickel) except for specially large orders.

In my experimentation I have found the twenty-five per cent. grade far superior in every way to the eighteen per cent. Besides its natural properties of flexibility, ductility, strength, etc., the higher grade is especially susceptible under proper manipulation of being made exceedingly rigid, a desirable property for jack and traction bars. With further drawing it is nearly as resilient as tempered steel, a property necessary for rotating and alignment wires, spring expanders, contractors, etc. Again, it can be made sufficiently soft and pliable to permit the most accurate adaptation.

Its high fusibility permits the use of any of the gold or silver solders. Its deleterious influences as a metal in the mouth, for the short time it is worn, are no greater than gold. The danger in this particular lies far more in loose methods of construction and attachment of the apparatus, preventing the dislodgment of decomposing detritus. Its appearance when compared to gold is a real objection, but even this is largely obviated by electro-plating, followed by perfect cleanliness in the mouth. Its cheapness is greatly in its favor, permitting, in infirmary practice, the lavish use and destruction of material for every appliance desirable, at a very small fee.

Even in private practice the influence of its cheapness is toward the employment of more original and scientific methods. There will not be the same tendency to use certain stock material or parts of apparatus that you happen to have on hand with a very questionable endeavor to make them do, as you might if they were gold. Nor will you hesitate to cut away and remove apparatus or parts the action of which is found to be inadequate or not as anticipated, or that which the progress of the case has outgrown, with the view of substituting others better calculated to meet the demands.

Before taking up the technic work in detail I wish to speak of some of the difficulties we have encountered heretofore, especially in the teaching of this branch, and to suggest remedies.

We have always experienced difficulties in obtaining proper draw-plates and screw-plates that would enable students to draw wire to the several sizes desired, and to the exact diameters requisite for cutting full and perfect threads with a Martin screw-plate. The reason for this is that there is at present no exact standard of uniformity in the sizes of the holes of different draw-plates marked with the same letter, nor is there a harmonious relation in the graduation of the holes.

Draw-plates being made to merely reduce the sizes of wire within the range of their several fields of capacity, there is also no relation whatever between the sizes of its holes and the sizes of wire required for perfect threading in any of the screw-plates. This is true also of any of the standard gauge sizes.

Students in drawing wire through an ordinary draw-plate frequently find that when drawn through one hole it is too large, and if drawn through the next in size it is too small. This demands the enlargement of the smaller hole with emery strips; in fact, the readjustment of a number of holes in the draw-plate to the required sizes of the screw-plate in use.

Again, when drawing wire, on approaching the particular size required, students are obliged to have frequent recourse to a micrometer caliper, as the standard slot gauges, as I have said, do not measure the sizes required by the Martin or any screw-plate. As the caliper is an expensive instrument, the one owned by the demonstrator or the college has to do for the whole class, a fact that often occasions considerable delay in large classes.

Again, in making tubing with the ordinary draw-plates it is necessary to have an extra draw-plate with holes much larger in size, in order to obtain the use of the two or three large holes required to turn and approximate the joints previous to reducing the tubes in the regular graduated holes.

Several years ago I originated the idea of inserting in one end of the regular draw-plates three extra holes for this purpose, since which time these have been in market and have subserved a good purpose, but they are far from perfect in this and other particulars.

In the Martin screw-plate we have fortunately found a standard of sizes; that is, screw-cutting holes of any number are intended by the manufacturer to be exactly the same size in every plate of the same letter, regardless of differences in other particulars. I have found, however, that different batches of screw-plates will often differ in this particular, so much that a nut threaded with a tap made in one plate is unfit to use on a wire threaded in another.

When it is remembered that the height of a thread on the smaller screws is but .003 of an inch, you can appreciate the difficulty of preventing the slight difference that would cause a misfit, especially when you also remember that .003 of an inch, or No. 40 B. & S. gauge, is the thickness of thin writing paper. Nor is this difference material when the tap for threading the nut and the wire upon which it is to be screwed is cut, as it should be, in the same screw-plate. It, however, explains a common trouble which dentists experience who are forced to depend upon store taps or nuts that have been made by the use of a different plate than the one they use to thread their wires, and it is also one of the many arguments in favor of technic training.

Another difficulty arises in the frequent breaking of the steel taps while they are being threaded, especially by beginners. This is due largely to the fact that with a screw-plate even so perfect as the Martin the complete thread must be cut practically in one hole, because the two holes under one number in any of the present screw-plates are nearly or quite the same size; the difference, being so slight, is of no practical advantage.

The operation of cutting a complete thread at once requires something more than the greatest care to prevent the necessary strain from breaking the steel shanks of the smaller taps. This is also true of the smaller regulating wires when they are drawn to a hard temper and sufficiently large for a full thread. It may be suggested that we begin the cutting in some of the larger holes, and the thread thus partially cut could be safely completed in the required one. In fact, a very good teacher once told me that he so instructed his class. He was probably not aware that holes of different numbers differ in the number of threads per inch, as well as in size. Consequently it is not correct practice to start to thread a screw in the No. 4 hole, for instance, that is intended to be finished in the No. 7, for obvious reasons.

All these difficulties which I have enumerated in the use of the present draw- and screw-plates we now hope to completely obviate by the use of new plates at present in course of manufacture, which will be specially constructed to meet the needs of this particular department.

The new "dental gauge draw-plate" (see Fig. 1) will contain all and only the draw-holes we require. Moreover, they will be cut as regards size to strike an unbroken series of standard American (B. & S.) gauge sizes, and the official numbers of the same will be stamped adjoining their respective holes. Intervening gradation holes between these sizes will be unnumbered. Wire being drawn with this plate will not require a gauge to determine its size. The plate will also possess the three extra holes for starting tubing. These will be regularly constructed draw-holes, in size Nos. 5, 6, and 7. The graduated draw-hole series will commence at No. 8 and end at No. 24. These plates are also intended to contain five ovoid flattened D holes for drawing hook and reinforcement wires, which will be of far more practical shape than the ordinary D wires.

The new "dental screw- and gauge-plate" (see Fig. 2) will have along its edges a broken series of standard American (B. & S.) gauge slots for measuring only those sizes we require of wire, plate, and banding material. The official numbers of the sizes will be stamped in the plate adjoining their respective slots.

As a special feature of the plate, the screw-cutting holes will be specially constructed for perfectly threading the standard American gauge sizes of wire which we need for the work. Each pair of holes for making one screw will be placed on a line with and under the number of the gauge slot, which measures the wire they are intended to thread. Of these holes one will cut no more than two-thirds of a complete thread; the other will finish it, a feature which we hope will effectually prevent the future breaking of taps and small wires.

One of the many advantages of this system, which reduces all

Fig. 1.

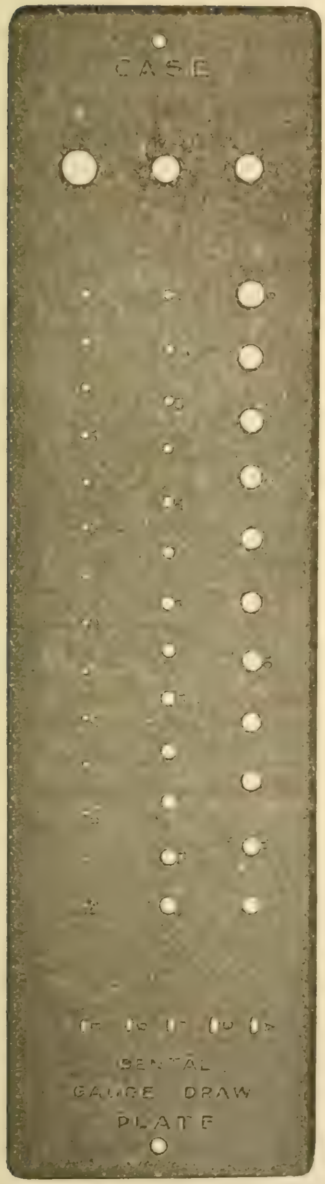


Fig. 2.

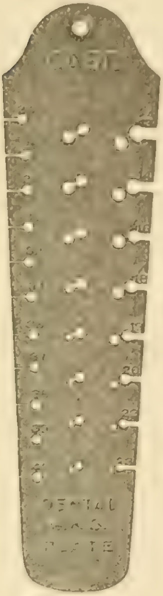
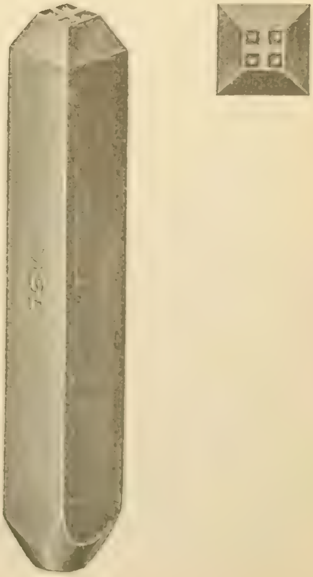


Fig. 3.



our sizes to a single standard, is that we will avoid the confusing necessity of designating these sizes in our teaching; at one time according to B. & S. gauge, at another according to the number of hole in the Martin screw-plate, and again in the thousandth of an inch.

When once established, all sizes of wire, tubing, nuts, screws, plate, and banding material will be designated by the simple use of name and number.

I have thus fully described these plates and their comparative advantages; not alone because I believe they will mark an era in the advancement of orthopedic technics, but more especially to simplify my description of the laboratory work which will be founded upon their use.

By referring to Fig. 2, which represents a face view of the "screw-and gauge-plate," the eight gauge slots on the right, with their respective numbers from 13 to 23, inclusive, designate all the special sizes of wire used for regulating, and which the adjoining screw-cutting holes are designed to thread; while the eleven gauge slots on the left of the plate, with their respective numbers from 24 to 40, inclusive, designate all the different thicknesses of plate and banding material.

In presenting a syllabus for the teaching of orthopedic technics I can do no better than describe in detail the course pursued at the Chicago College of Dental Surgery, which is similar, with slight variations, to that at the Western Reserve Dental College.

The course is confined to the first four months of the junior year, and occupies two half-days of each week.

It consists in the construction of implements for technic use, stock material, and technic regulating apparatuses.

The implements and stock material, when finished, are neatly mounted on cards of uniform size, furnished by the college, and marked with the name of student and number of section, to be turned in for grading.

This material is intended to be distributed to tabulated boxes, containing "college regulating stock material," and ultimately to be used for practical cases by the seniors. We have found this feature of the greatest importance in obviating the difficulty of obtaining and having in college stock proper regulating material.

The technic regulating apparatus of the course consists in the construction of one of sixteen standard regulating apparatuses, which are intended to cover all the ordinary demands for the regulation of teeth. Large working drawings of each of these are framed and hung in the laboratory. Students are also furnished with blue prints drawn on a smaller scale.

The apparatus, when finished, is gold-plated and mounted, with perfect plaster models, upper, lower, and occlusal, in a specially prepared box furnished by the college, and marked with name and section ready for grading. This box with its contents is returned to the student at the close of the senior year.

Before beginning the work the class is divided in alphabetical order into sixteen sections, or according to the number of technic regulating apparatuses they are to construct. Each student then knows at once what apparatus he will be required to make by comparing the number of his section to those of the working drawings.

Beneath each drawing will be found the name of the apparatus or the character of the irregularity it is intended to correct; also the sizes of all the material to be used, and special directions relative to its construction not shown by the drawing, though, as may be seen, it gives several views of parts difficult to understand.

The present drawings, as shown by the blue prints here presented, will be replaced in the coming year with others more systematically arranged, and bearing designations according to the new system of sizes.

As it would be too much to expect every student to make all the stock material required, it is divided among the sections in proportion to the needs of instruction and the probable demands in practical senior work.

I show you a laboratory chart with stock material attached, which designates the requirements of each section. From this it will be seen that, besides the technic apparatus of the section, each student is required to make one drill, one tap, and one wrench; two rotating wires, five inches long, Nos. 22 and 23, each carrying four inches rotating tubing to fit; two D wires five inches long; one No. 16 jack-screw, with tube and nut; one No. 18 traction screw, with tube and nut; one No. 18 reciprocating jack and traction screw; two prepared rotating wires, ready for adjustment; three prepared hooks, different styles; one roll waxed separating tape.

In connection with the above, Section 1 makes four five-inch pieces No. 13 wire, threaded one-half inch at one end, each piece bearing two nuts, and four inches of tubing to loosely fit; also two rolls banding material, two widths, No. 40.

Section 2 makes No. 14 wire, tubing, and nuts; otherwise same as above.

Sections 3 and 4, No. 16 wire, etc., and No. 39 banding material, as above.

Sections 5 and 6, No. 18 wire, etc., and No. 39 banding material.

Sections 7, 8, and 9, No. 19 wire, etc., and No. 38 banding material.

Sections 10, 11, and 12, No. 20 wire, etc., and No. 38 banding material.

Sections 13, 14, 15, and 16, No. 22 wire, etc., and No. 36 banding material, excepting that Section 16 makes No. 34 banding material.

All wires used for constructing regulating appliances are drawn *without annealing* from "hard" German silver wire, No. 9, the object being to obtain wires of a temper that will best subserve the objects of its uses, and exactly the right size to permit the cutting of a full and perfect thread in the screw-plates; two objects that cannot at present be attained by wires purchased of dealers.

The No. 9 wire is issued to the students in pieces sufficiently long for the requirements of each. These are tapered at one end to enter the draw-holes and be grasped by the draw-tongs. The force required to draw these large wires is so great that it is necessary to use an apparatus similar to a jeweler's draw-bench, rigged with windlass and crank.

The drawing of German silver wire adds greatly to its rigidity and resiliency. When hard No. 9 is reduced to Nos. 13 and 14, perfect material is produced from which contouring power-bows can be constructed that possess all the requisite properties. When further reduced and hardened we obtain at Nos. 16 and 18 the requisite properties for jack and traction screw bars. At Nos. 19, 20, and 22 traction and alignment wires, and No. 23 the smallest rotating wire.

The rigidity and strength of these very small wires drawn in this way, and the force which they exert when properly adjusted, cannot be fully appreciated till tested.

When the technic wire is drawn and its size tested in the slot of the screw and gauge plate, it is cut into four pieces five inches long, one end of which is then threaded one-half inch, and the extreme point abruptly tapered ready for the nut and final mounting.

The tubing is made of German silver plate, No. 28, excepting the rotating tubing, which is made of banding material, No. 37. The plate is cut into strips three-eighths of an inch wide and eighteen inches long, one piece being considered sufficient for the requirements of each student. The strip is first thoroughly annealed, then partially turned by laying it over a groove cut in a hard piece of wood, driving it down by the aid of a steel rod laid lengthwise upon it. One end is slightly tapered and solidly rolled to a grasping point by lapping the surfaces. Then it is drawn to loosely fit the particular size of wire for which it is intended, as has been fully described.

The rotating tubing is drawn to exactly fit the rotating wires. When drawn, the tubing is cut in four pieces four inches long, and slipped on their respective wires.

The difficulties attending the proper construction of nuts have, more than anything else, proven a great stumbling block to the teaching of this system of orthopedic technics. This has been partly due to the lack of trained and skilled demonstrators and the persistent teaching of roundabout and cumbersome methods to avoid difficulties, which, let us hope, will soon fade away under a more practical and systematized régime.

The steel for taps and wrenches is partially prepared by the manufacturer at a cost of about forty cents a dozen. The taps are made from engine-bur steel, cut into pieces two inches long, and lathe-turned at one end to perfectly parallel shanks five-eighths of an inch long, the exact sizes required for the several taps. At the other end a short shank one-sixteenth of an inch long, with abrupt shoulder, is turned the same size, to be ultimately threaded for finishing the nut. The student threads the tap one-half the length of the shank and files the end to a three-cornered taper, the facets of which extend one-half the length of the threaded portion. Then it is ready for tempering, which I need not here describe.

These instruments in use are held in a pin-vise.

This year we have commenced using with much satisfaction jewelers' twist drills, that are carefully selected as regards size, at a cost of about forty cents a dozen. In use they are held in a lathe chuck.

The wrenches are made of 5-32 octagon steel, cut six inches long, and dressed. These are made by the students into double-end wrenches of a standard pattern, which I have found to be most useful. One-eighth of an inch at each end is forged to an angle of forty-five degrees, and further flattened and tapered with a file to form the grasps. The slots are then cut with a flat parallel file to accurately fit two of the three sizes of nuts. They are aided in the fitting process by short pieces of square wire that have been drawn through a square-hole draw-plate to the proper sizes.

Up to the present time we have made the nuts from nickel five-cent pieces, in the manner described in former papers.

I now take pleasure in introducing a method which will greatly facilitate this work. It consists in partly stamping the nuts with steel dies. (See Fig. 3.) The dies can be made to stamp four nuts. A greater number has been found to be not advisable on account of the great force required in the stamping process. By examining the die with the nuts in progressive stages of construction, which I here present, it will be seen that the centers are deeply punched for drilling and tapping, and the walls accurately cut the proper sizes required, about one-half the thickness of the nut. The final sawing and finishing to these prepared surfaces will not be difficult. Among the important advantages of this method the nuts will be uniform in the sizes required, and with walls that are uniform in their distance from the threaded hole.

The work has been greatly simplified and systematized by insisting that the grasps of wrenches and the external sizes of nuts shall be accurately cut to three standard sizes, large, medium, and small. The large for Nos. 13 and 14, contouring bars; medium for Nos. 16 and 18, jacks and traction bars, and small for Nos. 19, 20, and 22, traction and alignment wires.

Nuts should contain no more body in the thickness of their walls than is necessary for strength. They should be slightly tapering, as an aid to grasping, and the free ends and corners rounded to prevent irritating projections.

The proper construction of banding material is one of the most important factors in regulating. It should possess the highest degree of pliability that is possible for German silver, in order that it may be drawn tightly round the teeth in measuring for the joint, and finally for the perfect adaptation of the band after it is soldered.

This can only be accomplished by thorough and repeated annealings during the process of rolling, and then after it has been brought to the required thickness it should be coiled into rolls and held at a red heat for one hour. The latter requirement may be accomplished by placing a large number of the rolls over a jacketed gas-burner, with intervening layers of plate or sieve wire to protect them from the direct action of the flame. Or they may be placed in the muffle of an automatic gas furnace.

Banding material is made of German silver wires, Nos. 9 and 13, which are both rolled to Nos. 34, 36, 38, 39, and 40, giving us two widths of each number. The requirement for each student is two widths, each two and a half feet long, of the size assigned to the section. The two sizes of wires are cut the required lengths for four students who work in teams to one gauge number. One and a half feet of No. 9 wire will roll to twelve feet No. 34 banding material, and one foot will roll to twelve feet No. 40. Two feet No. 13 wire will roll to twelve feet No. 34, and one and one-quarter feet to twelve feet No. 40.

These results are not unvarying, but will, I think, give a generous three feet of banding material of both widths to each student with which to fill their technic stock requirement, and allow for the technic regulating apparatus.

The waxed separating tape is prepared from German flax tape, which costs about twenty-five cents per gross. We obtain it in three widths, three-thirty-seconds, five-thirty-seconds, and one-quarter inch, the latter to be used double for wide separations. The skeins are rolled to hard coils, using a match for a starter and twirling handle; then they are dipped into boiling white wax.

DISCUSSION.

Dr. S. H. Guilford. I have nothing but commendation for the work and the paper of Dr. Case. I see the advantage here of having some one who gives his exclusive time to work of this kind in the dental college. In our Eastern colleges I believe this has not been the case. The matter has rested upon the one who taught operative dentistry, and I feel sufficient time has not been given to it. On the other hand, there is the danger of carrying the matter too far. Dr. Case anticipated that objection in the early part of his paper, that the question might arise as to whether we were giving too much attention to it. I don't think we can give too much attention to principles, but I think, with our present courses, we are apt to give too much attention to detail. While his work and drawings are very admirable, it seems to me some of them can be dispensed with. If I were to undertake to do that in my college the students would have to give four months to it, or two half-days each week for four months. The question is whether we could do it and give them time enough for the other work. As to making taps and dies, the students in the different colleges of Philadelphia have simplified that very much. That is to say, we can buy from the manufacturer square wire made of German silver, any size wanted, correctly made, in full lengths, or cut up into suitable sizes for nuts. Some years ago I went to a manufacturer in this city, and he made me partially prepared nuts. From a solid piece of wire the nuts are made of different lengths, and we save the necessity in that way of stamping out of solid nickel what we can get ready-made.

In regard to the die and die plate, Dr. Case has done very commendable work, and of which I have heard for the first time to-day, of having plates made of uniform sizes. I have realized the difficulty of drawing down wire to a correct size. There are not enough holes in the draw-plate, and they are not correctly gauged. We have obviated that difficulty, as Dr. Case has also, by taking No. 8 or No. 9 German silver wire, having it annealed, and then drawn through a draw-plate. Mine came from Cleveland, and we find it a very excellent thing. We have it in the college ready for use at any time. Before we draw we see that the wire shall be the same size as one of the standard holes of the draw-plate, but when the new draw-plate is out it will be a great improvement upon that.

The point I want to make is this, that with regard to making the nuts we have simplified that by having them partly made for us. Dr. Case uses three sizes of screws; Dr. Angle has two sizes. I have found in my work that one size is generally the proper size. It answers my purpose; so that we confine ourselves to one. To the same man who furnishes the wire I took a pattern I had, and he made this die, which he sells at about a dollar and a quarter. There is but one size, but it is the most perfect in the world. It is made like a machinist's die they use for cutting threads. I presume the most of you are familiar with it, but if I had anticipated this coming up this morning I would have brought some of them with me. By taking away some of the roughest work, I believe in their drawing down the wire; they have to do that. But when it comes to stamping out nuts and work of that kind, I believe the time can be more profitably spent in other ways. So I feel that much of the work should be done by some one outside, and that the finer work should be left for the students to do. By combining the two you save the students time and get the same result. In my experience I cannot recall a case where I have needed more than one size of screw and nut, different sizes and different lengths, but one gauge.

The plan and details of Dr. Case for orthodontia technic is very admirable. It is much fuller than anything else we have ever had on the subject, and I am obliged to him, for it will help me and others. I don't propose to copy it in its entirety, but I propose to get some valuable ideas from it. One of the things that appeals to me is the idea of getting up a draw-plate gauge-plate that will enable us to do our work better than we have done.

Dr. T. E. Weeks. While I do not teach orthodontia, I am somewhat familiar with the plan that is practiced by Dr. Weisse, and I feel rather familiar with Dr. Case's ideas, for the reason that through our intimate friendship I have probably obtained more of his ideas than I otherwise would have done; but I want to say a word in regard to the presentation of this technic. I think we cannot thank Dr. Case too much, for it is very complete. His idea was to give a full presentation of the whole subject of orthodontia technic, and it is in harmony with the ideas of the men who have presented syllabi and outlines of their branches of technic, that they would be complete, and thus enable teachers to select such as could be applied to advantage in their own work. And I think we ought to make an effort to keep this in mind all the time. In our association I have noticed a tendency to interpret what was rendered as being urged for all. I am not certain that Dr. Case's idea was in entire harmony with the other lines that have been presented, but it was a very full presentation for the express purpose of giving every one an opportunity to select. It seems to me that what we should endeavor to get out of these presentations is to select a course that will include the best, and let that course be adapted to our own individual needs.

Dr. G. H. Wilson. It seems to me we are apt to look at this work as something more than the rest of us are able to accomplish. We know Dr. Case has accomplished it, but why? Simply because the work has been systematized; and that is the real aim of our association. This work is put into the hands of a man whose business it is to teach this. He is given a certain amount of time, and he should develop it to the very highest point possible. That is what Dr. Case has done. You can see what is possible when it is systematized. The amount of time given this work is no more than the subject demands, but, at the same time, it is making the best use of the time. So I believe that the lesson for us to learn to-day is to systematize our work, and then more can be accomplished in the time at our disposal.

As to having material prepared for us, to a certain extent I don't believe it is the best thing. I believe the more manipulative work we can compel our students to do, the better it is. We want to learn to use our hands. We had a fine demonstration of that last night. If we as dentists could use our hands as we saw the young men do it I believe it would be a great benefit, and that is only accomplished by repetition. So the more we compel our students to do, the less time they will have to spend in the smoking-room.

Dr. J. G. TEMPLETON. I have heard lectures given by Dr. Case quite a number of times, but never before saw him illustrate anything in regard to the technics of orthodontia. There was one thing he mentioned that I was very much pleased to hear, and that is in reference to obtaining a knowledge of physics as a preliminary qualification to this work. The knowledge of physics, so far as the law of force is concerned, is a very great advantage in all prosthetic work; particularly so with regard to this work. By having this knowledge of physics a person understands where to apply the force, and where the force will come by using these appliances.

Dr. N. S. HOFF. It seems to me that the presentation we have had this morning will make us realize more and more the necessity for this organization. Although I have known considerably about the work which Dr. Case has been doing, I have not had a proper conception of the method he has employed in instructing his students; and the thoroughness with which he has gone into the details gives me some idea of the value and necessity for a complete presentation of this work in orthodontia technic. We have never before had anything like an adequate presentation of this matter to us, and it only serves as a beginning. Dr. Case in this presentation has given us only one method. There are other methods, and these will in due time be presented to us, and by and by we shall crystallize these different ideas into a complete system. It is again evident that our work is not done. We here have only the beginning in this particular department. Many have thought there was not enough to keep up interest in this association in years to come. Here we are starting out on a new subject which has been clearly presented, and only one phase of it has been shown. Dr. Case has not even suggested the technic of the application of the appliances that he has shown us for the accomplishment cf the purpose for which it is intended. There is a technic in the application of appliances which we must have to give to our students; how this material is to be utilized in correcting irregularities. Some day we will get down to fundamental principles in that respect. There is an opportunity for enlarging this work, it seems to me, of which we can hardly see the end. It would occupy our whole time for perhaps a week to discuss this one part of our work. I feel that we are greatly indebted to Dr. Case for so ably presenting to us such a complete system as he has here presented for this part of our work. I hope next year we may have a further presentation, including also other methods.

I am very much interested in this particular line of work. In our school we teach it, but not to the extent shown here, which I hope we may do and make our teaching in this subject more systematic than it has been. We teach other methods; none of them are complete or satisfactory. When we get a presentation from other specialists who are doing the same work by other methods and means, as fully as this has been, by bringing them together we shall have a complete system of the means used for this purpose. I don't think we could have a better basis for our work than the one that has been presented here this morning. I want not only to compliment Dr. Case for the manner of the presentation, but to thank him cordially for the thoroughness with which he has done it. He has gone to great pains to present the matter with all this detail, and I am sure we owe him our best thanks for it.

Dr. W. H. WHITSLAR. The argument presented by Dr. Guilford as to having students buy material is one I think not quite correct, for the reason that about fifty per cent. of the students will go into the country to practice, or in country towns where this material cannot be purchased, and it is necessary for them to be competent or able to prepare their own material to work with. Often they do not have the means to communicate with merchants in large cities, and don't know where to buy these materials. For that reason I think it is advisable for them to prepare these different instruments, wires, nuts, and so on, for themselves.

Dr. H. J. Goslee. I am quite familiar with Dr. Case's system of technic work, having had the honor of being his associate for three or four years, and I cannot resist the temptation of adding a few words of approval of the outline he has presented to us here to-day. When I think back only three or four years, and see the results we got from our students at that time and compare them with those we get to-day, it is almost astonishing to see the improvement. That improvement has been gradually made by time, thought, and study. It has been worked out carefully by Dr. Case, with results that are better by far than they were then; and this result is due largely to the fact that the students have been required to make these appliances themselves. At the time I speak of, three or four years ago, we permitted them to buy the tubing ready-made; buy the wire, the taps, supposed to be of the proper size, buy anything they could that would answer the purpose. Those students when they got through didn't know anything about regulating or the construction of regulating appliances as compared to the boys of to-day. We all appreciate, I am sure, the manual training that the construction and preparation of these various materials must give the students. We all appreciate the value that it is to them. Dr. Guilford said he did not think we had time enough to present this subject as thoroughly as Dr. Case has outlined it. I would like to say that it does not consume a great deal of time. I dare say we do not devote much more time to this work in our school than Dr. Guilford does in his, but it is so thoroughly systematized more can be accomplished. Two afternoons a week for four months is not a great deal of time, and I am pretty sure the average curriculum of the average college could find plenty of opportunity to give to orthodontia technic that much time.

About dies for nuts, Dr. Case has brought them to a system of perfection and simplicity, and that has been a stumbling block in working out the system he presents; but we have found a steel die that will cut four nuts at once a success. Four or five minutes will finish a nut, stamp, cut it out, and thread it. When you have a systematic method the time consumed is not nearly so great as might appear from the time occupied in presenting the subject.

Dr. S. H. GUILFORD. I think Dr. Whitslar and some others have misunderstood what I said. I am an advocate of students preparing their own material. The only point I made is in the kind of material. I mean the matter of making nuts, which is one of the most difficult things they have to do. If they have a die it can be done, but if each student has a die it will add to the expense of the equipment. The wire costs almost nothing, and it don't help the student much to make that wire.

Dr. H. P. CARLTON. Dr. C. L. Goddard handed me a syllabus which he uses with the students of our school. Dr. Goddard gives his whole time to teaching these subjects. We have a complete course of this character. The syllabus follows:

As I cannot be present to take part in the discussion of the paper on orthodontia technic, I will offer the following description of how the subject is taught in the Dental Department of the University of California.

One lecture a week is given to the senior and junior students assembled together, and, in addition to this, the juniors are instructed in "technic" by my assistant, while the seniors treat practical cases throughout the year under my personal supervision.

By many it may be thought that lectures on this subject should be given to seniors only, but I find that they are better prepared for the practical cases of the senior year if they have listened to lectures during the junior year, and that they need a repetition of them to fix methods and appliances in their minds. The lectures are illustrated by drawings, lantern slides, and blackboard work.

The drawings of the teeth are made in black and white, but the appliances are drawn in different colors, as follows: Yellow representing gold or German silver; gray, platinum; blue, steel; dark red, vulcanite; green, soft rubber; pink, silk or linen ligatures, etc.

I think the subject is best illustrated by blackboard drawings, because the irregularity of the teeth can be first outlined in white, then the appliances added in colored chalk; and the construction thus clearly explained in its various stages.

For convenience of description and illustration, irregularities are divided into fifteen classes. The etiology of each class is explained with more or less minuteness, and authorities quoted.

Oral quizzes are held occasionally to review causes, plans, and theories. Quizzes on treatment are held as follows: The blackboard is covered before the lecture with drawings in colors, representing classified irregularities and various appliances for their treatment. These drawings are numbered, and students are called up in turn to point out and explain the irregularity and treatment. Students seem very much interested in these quizzes.

On one of the walls of the lecture room is a small cabinet, in which are placed, before each lecture, casts illustrating that lecture. These casts are left in this cabinet till the next lecture, for inspection.

The orthodontia technic work is conducted by my assistant, but under my directions, as follows: Each junior student is provided with a piece of No. 13 B. & S. gauge German silver wire and a piece of 23 plate. From these he is required to make all the prescribed appliances that can be constructed of that metal. Other metals or materials are provided when necessary.

He is required to roll out plate, draw wire, make tubing, both round and square, cut threads on wire, make a drill and tap, nuts, and a series of "partly-made" appliances. These are all placed on a card prepared for the purpose, and constitute the first set of appliances that can be used afterward in constructing a few typical ones that are fitted to and presented on plaster casts. Original models of a few typical cases are prepared by my assistant, from which students take impressions and make their own casts. The models and appliances required are varied somewhat each year.

In the senior year each student is required to treat at least one practical case of irregularity or deformity. Whenever possible, a cleft-palate case is assigned.

The superintendent of the infirmary assigns a patient to each student, who first fills out a blank descriptive of the case, takes impressions, and makes articulated casts of the upper and lower teeth. At a weekly clinic the patient is presented for my inspection and advice. After examination a drawing is made on a blackboard near the chair showing the irregularity in white; then the appliance prescribed is added in colored chalk, and described to the surrounding class. If the case presents any unusual features, a clinical lecture is given then and there. These short talks are very valuable in supplementing the regular didactic course, and the students' attention is called to many phases of eruption and changes in position of the teeth that cannot be shown except in the mouth or on the face of the patient.

The student in charge of the case in hand is instructed to make the prescribed appliance, place it on the patient's teeth, and present it at the next clinic. As soon as one case is thus disposed of, another is taken up in the same manner. The same patients are presented at subsequent clinics for inspection and advice until the correction is completed.

In a wall cabinet with a glass door, just behind the chair, all the original articulated casts are kept, so as to be readily compared with the patient at the clinics and progress noted. A record is kept of each inspection of the patient.

I want to say just a word about where the clinics are held. I use a chair that fronts a window and is beneath a skylight. There is room for quite a number of students to stand so as to see the case well without obstructing the light. Behind the chair is a washstand with running water, provided with soap, nail-brush, and clean towels. On one side of the stand is a blackboard with eraser and colored chalk. On the other is the cabinet with a glass door. Spaces are reserved for the casts made by each student, and the student's name placed in front of the shelf, so that any case can be found in a moment. In this cabinet are kept a few instruments and supplies that may be needed in the clinic.

When a case is completed and a retaining appliance in place, if necessary, the student presents articulated casts showing the teeth in their new position. He also makes a duplicate of the original model, and places on it the appliance used or a duplicate. These three casts are then fastened to a small board, and show successively the case as begun, in progress, and completed. In some cases additional casts are made to show different stages of treatment or changes in appliances.

In the exhibit presented for your inspection specimens of our junior students' technic and senior students' practical work are shown, as also copies of directions that are furnished each student before work is begun.

I regret that I cannot be present at this meeting to see the rest of the exhibit and hear the papers and discussions. I have much yet to learn, and feel that that is the place to learn it.

Dr. W. E. GRANT. I was glad to hear the paper and what Dr. Wilson has said as to the importance of one devoting his time to this work, and to the number of hours allotted to it. That is the keynote to all technic work, the amount we try to accomplish in the schools. When we come to consider the number of hours, Dr. Case, as I understand, gives ninety-six hours a session to this work, six hours a week for four months. Those of us who feel we could not give that much time could give seventy-two hours, or even fifty-four. In my school we now give fifty-four hours a session to orthodontia technic work. I find it is not only beneficial in giving manual training, but by varying it, that is, by assigning students to some piece or to phases of the work that represent the views of different authorities upon this subject, that they become familiar with the different men's ideas. For instance, I have them make some of the work that represents Case's idea; again, work that represents Angle, Jackson, Guilford, and others who have suggested some special appliances. It gives them a technique and an idea of the application of the different classes, and they get it in a better manner than I could possibly present it in demonstration or by didactic lectures.

Dr. C. S. CASE, in closing, said: I don't think there is anything more I need to say, except to thank you for the words of commendation that you have expressed for the work we do along this line.

In answer to the question relative to seamless tubing, I have had no experience with that, as we do not need it at all. The seams of all tubing are soldered next to the band, and the solder closes the seam. In other places, where the tubing is free, it is not necessary to have the seams closed. They never open if they are closed properly.

In regard to the construction of nuts, it has been for some time a stumbling block, although the method of making them of some solid material is far superior to anything else. You get the advantage of all the solid material in the strength of the threads of the nut. In fact, we have tried every method that has been used. The method that Dr. Guilford has spoken of has been tried by us. We have found that it does not favorably compare with the method of making them out of the solid material.

PRINCIPLES AND TECHNIQUE OF ROOT-PREPARATION.

By H. J. GOSLEE, D.D.S., Chicago, Ill.

There is probably no distinctive feature in the teaching of the subject of crown- and bridge-work that is of more intrinsic importance, that is more negligently treated, and that is more replete with attending difficulties than a consideration of the proper and skillful preparation of the roots of teeth for the purpose of restoring their natural condition by means of accurately-fitting artificial substitutes in the nature of crowns. I can, indeed, conceive of no other more important phase of the entire subject that is treated in such a perfunctory manner by the profession in general, and yet to this seeming indifference or negligence, wherever it may be apparent or manifest, can be attributed much of the trouble and many of the failures which must ensue.

The common cause of such failures and countless discomfitures in the shape of gingival inflammations and peridental and alveolar absorption can be almost invariably traced to the irritating influences of an imperfectly adapted band, due primarily to faulty root-preparation. And yet, since the profession has in the main agreed that the crown with a band, because of the additional protection and stability afforded, is the ideal crown, it necessarily falls upon us as teachers to take the initiative in endeavoring to correct the mistaken ideas, cultivate the field of errors, and place the proper significance and importance upon the requirements.

As the architect and builder intelligently and systematically prepares the foundation for that which is to stand as a monument of his skill, with the same care, precision, and accuracy must the foundation for work of this nature be prepared. Success in any line of mechanical procedure means method, system, a clear, concise comprehension of principles involved, and strict attention and adherence to the most minute of details. Particularly is this so where art and mechanics are merged together, and where the field of labor is confined to vital sensitive tissues.

While the requirements of a crown are fit, occlusion, and approximal contact, the first is the primary and essential element to ultimate success, permanence, and comfort, and is entirely dependent upon not only a conception of the underlying principles and a thorough execution of the details and manipulative procedure, but a knowledge and appreciation of the significance of their importance.

It is my purpose to so emphasize as to impress this upon us; to advocate that the importance demands a systematic and practically scientific arrangement of the subject, and, incidentally, to present to you a concise outline of the teaching methods I use and suggest in this respect.

That the subject may be best, and perhaps most easily and intelligently considered, I have decided it advisable to divide it into two general classes: Root-preparation—First, requirements; second, classification.

REQUIREMENTS.

This portion of the subject includes the necessary preliminary or primary procedure, and, consisting of three steps, is in turn subdivided as follows: Requirements—First, treatment, filling, and preparation of canals; second, restoration of continuity of walls; third, destruction or diminution of crown.

Treatment, Filling, and Preparation of Canals.—This consideration is given precedence for the important reason that it should invariably precede the sacrificing or removal of any of the remaining portions of the natural crown, because of the advantage thus rendered in the application of the rubber dam and the necessity for it, without which the facilities for the success of the operation may be materially impaired. The preparation of the canals will be subsequently considered.

Restoration of Continuity of Walls.—This second consideration becomes necessary only in those cases where decay is more or less extensive toward the cervical portions, and which, when accomplished, prevents the possibility of fracturing the remaining unsupported walls in the preparation of them, greatly facilitates the fitting of the band, and overcomes the probability of future decay because of imperfect adaptation of the edge of the band to the margins of deep cervical pockets. This procedure is of great importance in many cases, and can perhaps usually be best done with amalgam with the most permanent results.

The Destruction or Diminution of Crown.—This procedure especially refers to a consideration of the requirements which necessitate so shaping the remaining portions of the crown or root as to render possible the fitting and adaptation of a band to the constricted portion of the neck beneath the gingival border of the gum.

CLASSIFICATION.

In considering this phase of the subject we are, of course, governed by the particular style of crown indicated; and while crown-work is divided into two general classes, the shell or telescope and the post or dowel, the individual indications for a crown and the variation in the essential features of root-preparation require that it be considered in three general classes: Classification—First, preparation of root for shell or telescope crown; second, preparation of root for post or dowel crown with band; third, preparation of root for post or dowel crown without band.

For the purpose of illustrating the distinctive features and the requirements in these separate classes, I have had made a set of original models designed from actual measurements of typical tooth form, magnified twenty times in each diameter.

Preparation of Root for Shell or Telescope Crown.—Under this first class we of course meet with the most difficult operation, because of being confined to the posterior teeth; and most usually the molars, where it is necessary to secure a diminution of the crown dimensions at all points equal to the diameter at the cervix, and to sacrifice enough of the occlusal surface to allow for a reproduction of the cusps; while it is of course desirable to leave as much as possible of the remaining tooth-structure.

To secure this result it will be observed that at least the occlusal one-fourth of the crown must be sacrificed, and that one-sixteenth of the tooth-structures from each of the four walls must be removed in order that all occlusal dimensions may be reduced equal at least to the dimensions at the cervix where the band is to be fitted. The remaining "*stub*" will give a very lucid idea of the required diminution of the crown, and the thick edge of the sectional rim will clearly demonstrate the amount of tooth-structure sacrificed to secure this absolutely necessary preparation.

The absolute necessity for the removal of tooth-structure when an artificial substitute for the crown is indicated is at once apparent, while it is readily granted that the same entails considerable effort, and may require the destruction of the vitality of the tooth.

The question of the feasibility of devitalization in the great majority of cases enters largely into and is probably the most important phase of the subject in this connection. However, I manifest no hesitancy in saying that in a large proportion of cases between the ages of eighteen and forty-five or fifty it is impossible to secure a proper preparation of these teeth without so doing, unless the patient be made a martyr and subjected to the tortures of the Inquisition, irrespective of the oft-repeated theories of ultimate death from isolation, from the irritating influence of oxyphosphates or oxychlorids of zinc to the denuded surfaces of dentin, from the presence of metallic arsenic in the oxids of zinc, or from the effects of the inflammatory stages probably present and due to the influence of caries before crowning.

Any of these, or a combination of them, might well be expected to cause subsequent troublesome manifestations at some period, remote or otherwise, but the primary fact remains that so much tooth-structure must be sacrificed, that the walls of the remaining root must be parallel in order that a crown may be perfectly fitted.

Can this be accomplished when vitality is preserved? Would the patient tolerate the intense, excruciating pain necessarily produced by a perfect operation in the average case? Would the pulp survive the shock? The exceptions would be in abnormally formed teeth, in cases of faulty enamel formation, sometimes where there may be no adjacent or occluding teeth, and in those conditions regulated by age; but the exceptions do not affect the rule, and the principles are an important part in the consideration of the technique of the subject in general.

Preparation of Roots for Post or Dowel Crown, with Band.—The second class of root-preparation is of no less importance than the first, the indications being principally confined to the ten anterior teeth, and necessarily involve the destruction of the pulp and much tooth-structure, since the artificial crown replaces the entire natural one with the seam of union at the gum line.

After the treatment and filling of the canal, the technique of the procedure is as follows: The continuity of the remaining crown proportions should be destroyed, so as to leave the buccal or labial and lingual walls standing alone and somewhat unsupported by dentin. In the destruction of these walls it is necessary, then, to observe the precaution of preventing a rootwise fracture by cutting through the enamel with a thin knife-edged stone at a line which, it will be noted, approximates the cervical one-fourth of the crown, when each wall can then be quite easily broken down to this point with pliers or excising forceps, which leaves the remaining root probably a sixteenth of an inch longer than the gingival border of the gum.

This distinctive feature in the preparation of roots for this now perhaps most common style of crown is essentially necessary and should be invariably observed, because of three decided advantages: First, this exposed portion of the neck of the root greatly facilitates the peripheral preparation, in that the remaining ledge of enamel can be removed with ease and dexterity; second, it renders the securing of an accurate measurement a simple and easy procedure; and, third, the end of the root here remains to shape and guide the band in fitting it to conform accurately to the walls.

When the band has been thus fitted, removed, and cut down to the proper depth, this remaining portion of the root is then sacrificed with flat-edged stone or root-facer to the proper line.

It will be noted here that the face of the root when the preparation is complete is but slightly beveled, so that the labial or buccal surface is a trifle shorter than the gingival border of gum, while the lingual is a trifle longer, with the angle formed by the beveling a little to the lingual of the center of root, the reason for each being obvious, because the buccal or labial must be shorter than the gum in order that the facing may be placed in contact with it, and the cap practically invisible; the lingual should be longer to overcome in a measure the force of leverage in the opposite direction, which is especially indicated in the six upper anterior teeth, and the angle slightly to the lingual of the center to allow surface for the approximation of the neck of facing to the cap.

Preparation of Roots for Post or Dowel Crown without Band.— In considering this, the third class of root-preparation, it may be advisable to mention that while such a crown is quite often indicated, yet, regardless of the adaptation, it does not insure the permanent results afforded where the root is banded, the success of such crowns depending entirely upon the adaptation of crown to root.

The procedure up to the removal of the remaining portions of the natural crown is similar to or identical with that indicated in the second class, but differs from this point in the fact that *peripheral preparation* is unnecessary; and that in cutting the root on down after the removal of the crown a lingual bevel is necessary in order, by thus *saddling* the end of the root, to overcome the force of leverage in an outward or lateral direction, such as is sustained by the artificial crown in the act of mastication.

The labial or buccal edge should be carried slightly below the gum line for the reason indicated in the preceding class, while the lingual should be longer than the gum, so that the adaptation of the base of the crown may be closely observed and the seam of union or joint between the two rendered self-cleansing by being exposed to the movements of the tongue and action of the saliva; while the angle produced by this bilateral bevel should also be a trifle to the lingual of the center of the root, to leave surface room for the facing.

In those cases of extensive decay resulting in the presentation of a concaved surface to the end of the root, where perhaps a crown without a band is either the only alternative or most frequently indicated, it may not be possible to secure this desired form; in which instance it becomes necessary to secure a perfect adaptation of the base of the crown to the entire surface of the end of the root in order to secure the best and most permanent results, and which can be easily accomplished by means of impressions, dies, swaging, and burnishing.

Canal Preparation.—Since the post or dowel in the crowns designated in classes 2 and 3 plays such an important part in the retention and stability of the crown, it is necessary that some attention be given to the preparation of the pulp-canals for their reception. This consists in enlarging them sufficiently to receive a post proportionate in size with the diameter of the root and the requirements of the crown, which should fit at least two walls, extend into the root a depth equal to the length of the crown from the end of the root to the incisal or occlusal edge, and project through the cap far enough to the lingual not to interfere with the facing.

While there may be some slight variations in the consideration of this subject, they will probably be mostly of an individual nature, and yet come under the same general principles herewith outlined. And I have purposely avoided all reference to instrumentation as far as possible, because of the ingenious individuality usually displayed in the manipulative methods of accomplishing such procedure and of its being in itself exhaustive enough to receive separate consideration, attempting only to impress upon us as teachers the value and importance of the principles of root-preparation as being synonymous with success in this line of work.

The address was illustrated with large artificial teeth, constructed of wood and in sections, so as to show the different parts of the teeth and the manner of operating upon them.

DISCUSSION.

Dr. H. W. Morgan. The models Dr. Goslee has presented appear to me to be most excellent. If I were a teacher in that line I should certainly enjoy very much having such to exhibit to my pupils. They show very clearly, and much better than words or diagrams, or anything else, the ideas they are meant to convey. Dr. Goslee's paper is the first presentation of this subject in a systematic way that I believe our association has had, and I wish to compliment him upon his divisions of the subject.

I would take issue with him in the restoration of his continuity. I think there are other materials which will answer as well or better than amalgam, but, as materials are not under discussion and we are speaking of technic, I shall confine myself rather to that feature of the discussion than to entering into methods and modes of practice as to material.

I was glad to hear him condemn dowel crowns without bands. Underlying the whole of the subject, it seems to me there should be a knowledge of the anatomy of the teeth. There is one point I would criticise, and that is the conflict of terms, as it seemed to me. The doctor used the term "gum line" frequently when he meant the gingival border; sometimes used the "gum" line when he meant the gingival line itself; and if he could have made any improvement in the paper it would have been along these lines in reference to terms. There was some confusion. We know when we come to trim down the root of the tooth, if we cut clear down to the gingival line, especially in the young, we encroach upon the peridental membrane. There is not much danger of gingivitis unless we have carried our band beyond the free margin of the gum and begin to impinge upon the peridental membrane or alveolar process. Therefore a knowledge of the curvature of the process in the interdental space should be first thoroughly understood. The gingival line itself, the curvature of the line, must be thoroughly comprehended before we can intelligently fit any band to a tooth. We must know the curvature of the anterior teeth and those of the bicuspids, and still more important it is to remember the curvature of the gingival line around the smaller teeth. A little more will be developed possibly in the doctor's next paper along that line.

I was somewhat surprised at the end of the paper, in looking it over, that he confined, or rather had defined, the title of his paper as a preparation of roots. It involves still more than that, rather the preparation of the stump. It is the preparation not only of the roots of the teeth, but of the stump that is left of the tooth. I would take issue there in that respect. In the preparation of the roots of the teeth I am very sorry, from the clinical standpoint again, that he did not go a little more into the minutiæ. I don't find it in my practice such an easy thing to remove that portion of the tooth which he very nicely showed us that remains after the tooth has been cut down to about that shape (indicating on board) and getting rid of this material, especially the enamel, that is left. Enamel cleavers and instruments of that kind do not always work so easily in my hands. It is a difficult matter, and especially to students just beginning this work, and especially so in an infirmary. I wish in his next paper he would just enlarge along that line somewhat. It would be of very great assistance to us.

Dr. H. P. Carlton. This appeals to me particularly as being a methodical and systematic presentation of the subject from the teacher to the student. The models are beautiful. I have never seen their equal anywhere. If I were a teacher of prosthetic dentistry I would at once want to possess a set of them. I can indorse, with one exception, all he said, and perhaps I may change my opinion in that direction. Up to this time I have not destroyed all of the pulps of the molar or bicuspid teeth in their preparation for the reception of shell crowns. I destroy more now than I used to.

The time may come when I shall destroy them all as Dr. Goslee says, yet I do not now destroy them in such a radical manner as he says he does.

Dr. I. N. BROOMELL. I wish to refer to one or two points. One of these is the necessity or relationship which should exist between the metal cap and the tooth-root, the tissue of the tooth. I believe it is customary in attempting to band the end of a root to make that band fit snugly and tightly to the tooth-tissue. I believe it is also customary to have the floor to the band set tightly against the end of the root. If we devote our efforts to have such a condition as that, we don't have sufficient room for the cement to serve its purposes. Therefore, I think in the preparation of a root sufficient space should be allowed for a definite amount of cement. This, of course, does not refer to the free extremity of the band, because there we must have perfect adaptation to conceal the cement within. In my teaching I always bevel the extreme end of the root so that I do not have a perfect adaptation of the band except at the extremity.

Of course we recognize that in the preparation of the roots of the teeth the amount of preparation depends very much on the condition of the root or crown, as well as the kind of crown to be applied. Dr. Morgan appears to take exception to some points in the essay by calling attention to the gingival border of the gum. I cannot conceive of such an expression to define the free margin of the gum, because in the gums we have the gingivæ; they are the gingivæ themselves, and speaking of the gingival margin of the gum we are repeating the word, beginning with that word and ending with it. It appears to me that the gingival margin refers to the edge of the gum, because the words are synonymous, gingiva meaning the gum. The term cervical line would be much better to use, because that gives us a definite point. The free margin of the gum or gingival borders are not always given a positive location. It may be more or less inflamed, and in that condition we have them somewhat extended beyond their normal location. In other instances they may have receded from some systemic or local cause, and then we do not have the positive line. The cervical line, which is a permanent line, that which defines the separation between the enamel and cementum, is the line to go by, rather than the gingival line, because the other is quite variable in its location.

The last gentleman spoke in relation to the destruction of the pulp. It appears to me it will only be a question of time when he will have to devitalize the pulps of the teeth which are capped with gold. I recall a case quite recently in which two bicuspids and a molar were all capped with gold, the teeth being vital when the caps were placed in position, with the consequence that the patient suffered the loss of the alveolus. She suffered great pain and disfigurement, and eventually suffered a fistulous opening through the cheek. I would most heartily always recommend the destruction of the pulp before capping a tooth with a metal crown.

Dr. C. J. Essig. I admire the models very much. They are beautifully made, and the scheme of the model is ideal. I think, as Dr. Morgan said, that a little detailed description of the instruments used and the method of reducing the margin for the reception of the ferrule would have been interesting. As Dr. Morgan states, it is one of the most difficult things we have to do in our office work to properly reduce these edges so as to receive the ferrule.

Dr. Goslee, in closing, said: Dr. Morgan referred to the restoration of the continuity of a root with amalgam. I believe my experience bears me out in making this assertion: Where the paper referred to the use of amalgam was in those cases where we have deep cervical pockets which it will not be possible to cover with a band, in which instances we must necessarily use something permanent; and there is nothing else I know of that would offer the assurance of permanency. I have been called to task for that two or three times, but if you will note the paper particularly you will see it refers to deep cervical pockets, where in all likelihood it is impossible to perfectly adapt a band to the edge or margin of the tooth.

My terminology and nomenclature was, I realize, not absolutely correct. I appreciate the criticism made by Dr. Broomell and Dr. Morgan with regard to the gingival edge. I believe that would be the correct term for those particular references with regard to the gingival border, where I spoke of it as the gum line. While they were not absolutely correct, they illustrated what I meant, though I was not right technically perhaps in presenting them in that manner.

Dr. Broomell has said what I would say to Dr. Carlton. I believe every one will sooner or later come to that conclusion. If you have any hopes of permanency in shell crown work it must be through the frequent destruction of the pulp.

With regard to the perfect relation of the band to the face of the root, if it fits the extremity perfectly we accomplish almost all we desire, and I feel sure the less cement we have the stronger must be our relation between the crown and root; because certainly if we have a cap fitting the face of the root perfectly there will always be room enough for a thin film of cement, and there will also be room in the pulp-canal for enough cement to carry that crown permanently.

SYLLABUS FOR DENTAL CURRICULUM.

By FANUEIL D. WEISSE, M.D., New York, N. Y.

I must preface the consideration by *me* of this subject with an apology for not being a dental surgeon. Thirty-five years' experience in helping to guide the evolution of the curriculum of the New York College of Dentistry is my excuse for venturing, in this presence, to express my views on the subject. In the fundamental medical departments we are on common ground, but in the dental departments I defer to the specialists in dental surgery.

I would here note that I have purposely avoided any allusion to the method by which the curriculum may be imparted to students. I have only epitomized the subjects that should be studied, giving the scope of each, to educate men for the scientific practice of dental surgery as a specialty of medicine.

The dental curriculum of to-day should include the study of the following subjects:

1. *Prosthetic Dentistry* in its respective fields of orthodontia and prosthesis.

2. *Operative Dentistry* in its respective spheres of extraction of and operations for the preservation of the teeth.

3. *Physics*—the physical and mechanical phenomena of matter and the forces which determine them, with a clear comprehension of the molecular physics of the materials used in, of the mechanical contrivances used in, of the mechanics of, and of the statics of the making of dental appliances and of dental operations.

4. *Chemistry*—the general laws of chemistry, the chemistry of the human body, and the chemistry of all substances, metallic and non-metallic, used in prosthetic and operative dentistry.

5. *Anatomy*—a general knowledge of the human body, and an exact knowledge of the descriptive and relative anatomy of the head.

6. *Dental Anatomy*—familiarity with the external forms, interior cavities, and cavity walls of the several teeth, temporary and permanent.

7. *Dental Comparative Anatomy*—a clear conception of the variations of the dental organs in the several classes of vertebrates.

8. *Normal Histology*—a general perception of all tissues of the body, and an exact perception of the developmental and mature histology of the tooth and its tissue environments.

9. *Physiology* of all the functions of the body, with particular consideration of the nutritive functions of digestion, assimilation, and disassimilation.

10. *Pathological histology* of diseased tissues in general, and a thorough appreciation of the morbid changes in the tooth and the tissues that surround it.

11. *Bacteriology*—the recognition of the bacteria found in the mouth, the laws of bacterial life, and the effect of bacteria in producing and carrying forward pathological conditions of the tooth and its root investments.

12. *Pathology*—the factors of tissue nutrition, the effects of aberrations of these factors, the results of irritation of tissue as presented in the phenomena of inflammation, and the reparative processes of tissues.

13. *Oral Surgery*—the abnormal conditions, of developmental, traumatic, or pathological origin, of the buccal parietes, with their surgical treatment.

14. *Hygiene* of the body in general, and of the buccal cavity and teeth in particular.

15. *Materia Medica*—of remedial substances used in dental practice.

16. *Therapeutics* in general, and the special therapeutics of all agents, prophylactic and remedial, used in the local or systemic treatment of morbid conditions of the tooth and of the structures covering its root.

17. *Anesthesia*—the agents used for and the methods used for the production of this state, both local and general, together with all restorative measures to be resorted to in cases of untoward symptoms resulting therefrom. In connection with the subject of anesthesia, it is imperative that the dental student should be made familiar, by didactic instruction and personal appreciation on others,

with the normal pulse, normal heart-sounds, and normal respiratory sounds, that he may be able to recognize the presence of variations from the normal, and in such instances decline to administer an anesthetic, local or general, without the concurrence of a physician.

I wish to make a special plea for the teaching of *physics*. But few of our dental institutions give the subject even a place in their respective three years' curriculum of educational work.

As a matter of fact, but few students enter a dental institution with a sufficient knowledge of physics to enable them to give the reason why a tool or instrument is made of iron, why a hammer has a wooden handle, or why a denture is held to the roof of the mouth.

Physics gives the reasons for the existence of every tool; as to the materials of which it is made, its construction, and how it fulfills its uses; and of every piece of apparatus, as to its material structure, its construction, and how it carries out the purposes for which it is intended.

Physics teaches the molecular forces that determine the properties of the materials used in prosthetic dentistry, and the laws which regulate the effects produced upon these materials in the application of forces to them. It is upon this knowledge that the prosthetic dental surgeon selects the materials and resorts to the procedures which enable him to carry out his work.

Physics guides in orthodontia; the selection of materials for appliances; the construction of the same, and the direction of force to effect given results.

Physics explains the reasons for the construction of the various operating instruments, the selection of the materials for the filling of teeth, and the results obtained by operative manipulations.

The so-called practical man may say to this plea for the study of physics, "I do not care for the how or the why! Give me the tools and apparatus, the materials and the practice, that I may obtain the results; these are all I care for!"

Such was the status of the dentist before the establishment of institutions for the education of men for the practice of dentistry as a profession. Dental educational institutions should see to it that such a status is not perpetuated at the present day.

To carry out the preparing of a "syllabus for dental curriculum" I would suggest that a committee of three be appointed to take charge of it, with power to appoint an editor from their number, to select collaborators of the several subjects, and to accept or reject the work of the collaborators. The editor to have charge of the final compilation of the accepted work of the collaborators. I would also suggest that the subjects be not worked out into questions, but that each subject be divided into detail heads, which shall present an analysis of the knowledge to be acquired.

DISCUSSION.

Dr. S. H. GUILFORD. I think most of the ground covered by Dr. Weisse's paper is already in practical use. In other words, I think the different studies he has outlined are the studies of the usual dental course, and what he has included under each head is what is included in all the colleges I know of. But I was pleased to note he made a special point of one branch which, as he says, has been largely neglected, the subject of physics. He says there are but two institutions of which he knows that even so much as mention it in their announcements. As our institution happens to be one of those, I feel quite highly complimented. The subject of physics is an important one. It is true the elements of physics ought to be taught long before the student goes to the dental college. We are not expected to teach ordinary geography, reading, and writing. The student is supposed to know these things before he comes, and so I have no doubt it will be in a few years after the dental course has been extended that the teaching of physics, except in its higher branches, will not be necessary for a dental college. We can't teach everything, but if the student has been properly prepared we can give him something that will be of use to him. We can teach him how these principles are to be applied in our work and practice. The whole subject includes more probably than a student would care to undertake, as it includes light and optics, and we haven't much to do with that; but we do consider heat and electricity as most important. The subject of dynamics is all-important. We have to consider the application of power and force and resistance, as when we are making artificial teeth and mounting teeth they have to be set in such a way as to serve the purposes of the individual. Wildman, thirty-five years ago, was the first to speak of so arranging artificial teeth that the line of force should fall within the center of gravity, and not outside of it. The line of force must be kept as nearly on the line of the center of gravity as possible. Then, again, as to the mounting of the teeth on blocks and single teeth, frequently the teeth break, and it keeps us busy explaining why that is. I remember an occurrence here in Philadelphia when the Public Buildings were being put up. The architect put heavy blocks of granite in position to support the weight that would rest on them. Everybody looked at them and smiled, and thought they would resist more strain than was to be put on them; but after they climbed up one, two hundred feet, and so on, it was found that portions of the granite blocks were chipping off, and then every one cried that the architect didn't know his business; that he had put stones there of insufficient strength to support the superstructure. The architect said if the people who criticised understood the principle upon which the stones were dressed, they would understand the whole problem. He said it was practically impossible to dress two stones so they would rest at all points, and, knowing that fact, men who dressed them dressed them so that the center should be a little higher than the sides and come together at the point best able to resist pressure. But in this case the stones were dressed in another state, and the instructions of the architect were not carried out, and the result was that the stones chipped. He said there will be no more of that. It is not the weight of the superstructure at all, but the fault of the dressing of the stone; and there has been no chipping since. In grinding blocks I teach the students, as Burchard sets out in his book, to make them so that they touch in the center, where they are the strongest and where they won't break.

That simply brings in the question of dynamics. Take, for instance, the filling of teeth where we are illustrating methods of putting gold in the cavity. We all tell them how to do it, but do we sufficiently impress on their minds why we do it in a certain way; why the gold in front of the plugger is at right angles to the plugger, so we can get the very best result possible? Do we tell them why we do it, so that every plunge or motion of the instrument is toward the center of the tooth, so as to have the effect of pushing the filling in the tooth instead of out? They know it might be pushed out when it is only half-completed, and we should explain why. So in building out the corner of a tooth, we teach them how to build down a corner in gold; and after that is done we want to tell them in the preparation of the cavity how to make as secure an anchorage as possible, and then they should know how to prevent the corner from coming off. The way to prevent the corner from coming off is to prevent any great strain coming on a point that is farthest away from the resistance, and so we have the application of force coming in continually.

In the matter of crown- and bridge-work as you see it here, if you explain to students exactly where the strain on the root comes, and how they can best resist that strain, that is a very important feature; and in the matter of orthodontia we have to deal with it constantly. What kind of force to apply and how much, and the checking or holding that force in power. Did you notice last night how the lecturer spoke of using the chisel, pressing with one hand and holding back with the other? Simply showing how to have control of the force. And so in regulating, we want to apply that force in the right direction, and have the means of stopping or resisting slightly the power we apply. I do not know of a place where a knowledge of physics or an understanding of the basic principles of physics does not come into use, especially the sub-department of dynamics. While we cannot, with our present classes, expect them to understand so very much about it, except those who have had a very liberal education, I think the time is coming when they will know more about the laws of physics, and all we will have to do will be to call their attention to these laws and make them understand how they should be applied.

Dr. J. TAFT. The subject or question of curriculum is one that has attracted a great deal of attention, but, after all, not very much has been done in the way of unification or bringing the profession up to the highest attainment in this direction in teaching. Effort has been made during the last three or four years by the National Association of Dental Faculties to bring into harmony the curriculum of the various colleges. The aim has been to ascertain or determine the best plan; the best arrangement of subjects; the appropriate time that should be given to each, and such arrangement of subjects as would best suit the classes taught. Not very much has been attained in this direction. I think this should be borne in mind, however, that this, like many other things, will be of slow growth. After all, we should all endeavor, so far as possible, to secure somewhat of this growth; take the things that recommend themselves to the general concensus of the profession, that present themselves in such a way as to commend themselves thoroughly to the teachers in the profession, and then let them adopt them. For instance, Dr. Weisse has a method that recommends itself to me; it is better than any method I have. Wisdom on my part would be to employ that as far as I can. If we cannot adopt it at once as a whole, take such part as you can and utilize it. If we are anxious to learn, we could in this way make more rapid progress than we have heretofore. There is one obstacle stands in the way in this respect, and that is that those who have been teaching for many years, and along certain lines, have formed a groove from which they find it difficult to free themselves from one method and adopt another; but that ought not to influence the younger teachers. You know how difficult it is to break away from habits of long standing. This is one of the greatest obstacles we meet in securing desirable progress in this matter. If we could all come up to the highest ideal point in teaching and work upon such lines, I am sure we should find our progress, although it has been great, much more satisfactory.

With regard to the subject so fully discussed by Dr. Guilford, that of physics, that is, of course, a subject that commends itself to the attention of every one. We all recognize the principles to which he refers as bearing upon our profession; not only in prosthetic, but in operative dentistry as well. Dentists should understand the principles of the application of force in a great variety of ways. Scarcely ever is a filling put in in which this should not be borne in mind. How is force to be applied to secure the best results, whether from the mallet, hands, or what not? Take a bicuspid tooth where there is a large approximal cavity involving a portion of the crown, a complex filling of that kind, many a time there is failure because of a want of attention in this respect, the application of force. A portion of the occlusal surface sets on the filling, or the opposing tooth comes upon it. It may be a filling well introduced, as far as that goes, but the strain comes upon it at a point that forces it from its position; and many a time, though well anchored, though not dislodged wholly, they are loosened so there is enough space for foreign substances to pass in, and there is a recurrence of decay. In order to avoid that the occlusion should always be noted when the filling is first taken in hand, to determine whether the occlusion is here or there, and then make preparations to meet that. Secure the filling well in place, and then trim the filling and occlude the point so that there shall not be that exercise of force which shall dislodge the filling. That illustrates the importance of noting the application of force, and how it occurs.

Dr. A. H. THOMPSON. All teachers appreciate the need that we are in to-day of a uniformity of curriculum in our schools. That has been worked upon to some extent by the Faculties Association, because they realize the fact that the different branches and different years of study create considerable confusion. With regard to students going from one college to another, there is great need of uniformity, and this should be reached by comprehensive methods and studies. But it is a matter that must be reached by evolution rather than revolution. I think we should take the matter under consideration and work toward it; not only toward uniformity, but also toward condensation of our work and the elimination of many things almost superfluous.

It has been suggested that we should require some elementary knowledge on the part of students entering our schools; that they should know something of elementary physics, mechanics, and elementary sciences, just as much as the elementary branches of education; and that it should not be necessary for us to take up the simple principles of physics, and then we can proceed to a further elaboration of their ability which will be more satisfactory.

Dr. WEISSE, closing. It seems I did not pronounce the word correctly. I said "few," not "two." I did not say there were only two colleges that gave attention to physics. I said a *few*. I have been much pleased with the corroboration of the views I advanced, —viz, my plea for the study of physics. Now, as a matter of fact, as I stated in the paper, but few students enter a dental institution with a proper knowledge of physics. It may be in the future that preliminary educational requirements will cover sufficiently the knowledge of physics to enable the student to understand many points that have to be explained in college, but, as long as it is not so, it seems to me some attention should be given in the dental curriculum to the subject. Of course, in speaking of physics I do not mean the physics of light, etc., as they have no practical bearing on dental work, but physics that have a practical bearing. Physics are constantly called into play, and must be in the thought of every operator. If it is not learned as a preliminary, then some direct attention should be given to it in the dental institution.

With reference to the presentation of this subject, it is not intended as revolutionary. I appreciate perfectly, as I have looked at the evolution of teaching in dentistry for the past thirty-five years, that it is a process of evolution. Nothing can be done by revolution, especially in educational matters. Dental institutions have now been in existence long enough to enable us to take an account of stock as to where we stand in the matter of the educational standard of dental colleges. I was asked to present a syllabus for dental curriculum, and I naturally presented a syllabus up to the present time. Of course that presentation covers much of the field covered by dental institutions in their education of men. It is simply a presentation of where we stand. It is simply a presentation of the heads of the subjects, with the scope of knowledge of these special departments which should be understood by the scientific dental surgeon of to-day. That is all. If many deans and professors of dental colleges were to look over this paper they would say, "We have that, and we have that." Of course you have. We all have it. But the question comes up, having it, let us make a statement of it. How many times do we hear it asked, "What do you teach dental students, anyway? Do you teach them this; do you teach them that?" We have gone through the period when it was asked so much. It is asked less now than at first. But it is still asked by institutions abroad, and by the profession abroad, "What do they teach in dental institutions in the United States? Do they teach dentistry alone, or any foundation of general medicine? What do they teach?"

It makes an educational starting point. How is it with a dental student just advancing upon his studies? He is at perfect sea as to what he is to learn. He sees professor of pathology, of anatomy, of operative dentistry, but he is at sea as to the field. But if he goes to a European country he can pick up a syllabus as published by the German government; he can pick up a syllabus of the examination questions he is to answer, and he knows the field he is to cover. Nothing is presented to the dental student of to-day as to the field he is to cover, except the heads of studies and departments. I do not speak of a series of questions, such as the student can cram up on. No, I believe in facilitating the student in every way possible in getting their education, and I believe you can facilitate that by telling them exactly what they are to learn.

It is not intended that this should be adopted by all institutions in the country. It is simply presenting the scope, the field. It is setting up a landmark, a mile-post, just before the century begins; just now, when we are turning into nineteen hundred, we put up a landmark; this is what is taught by the dental institutions of the United States. All may not conform to it, but it indicates what is being done and the consensus of opinion as to what is required. I request in the paper that it be not left to a single man, but that it be representative; that a committee of three be appointed, and that they select collaborators from the fifty dental institutions of the country, so that the labor will be light on each one. We will ask you to devote four or five hours to it. You can just note down the lecture heads of what you insist on, and present that as a report next year. It might not be perfect; it is not intended to be perfect at once, but it is a starting point. Eighteen hundred and ninety-nine; here we are; this is what constitutes the education of the dental surgeon to-day.

OPERATORY METHODS.

By W. H. WHITSLAR, M.D., D.D.S., Cleveland, Ohio.

If the beloved Professor Chapin A. Harris were called upon to inspect our dental colleges, he would bless the men of to-day for their great zeal and for the wonderful progress they have made. Colleges are becoming replete with modern invention, for the scientific instruction in dentistry. The strain of the "survival of the fittest" is upon us, though new schools are constantly seeking admission to the realms of pedagogy.

Encomium upon encomium may be showered upon our directors and trustees for their successful efforts in placing within our reach, as teachers, the means whereby colleges may become perfect organizations. Nothing in this world is absolutely perfect, and this applies quite markedly to the dental college. All are lacking in proper financial endowment to establish chairs, which will enable creative geniuses to elaborate ideal courses of study and proper methods for their pursuance. No college will be complete until it can provide amply every facility for the advancement of dental science, with sufficient and competent "human tools" to enhance the *ensemble*. Until such time we can approach in a small degree only the satisfactory conditions that meet the approval of our higher ideals. Dental colleges, at present, are to a large extent dependent upon self-sacrificing men to promote their interests, these sacrifices not being comprehended by the profession in general.

The rise of dentistry has given an impetus to its every factor, and now mediocre methods have given way to systematic teaching, and the wheels of true dental teaching have begun to revolve.

For the purpose of learning and presenting some of these systems, it was my privilege to receive from thirty-five of our dental colleges generous and kind replies to a large number of questions, some of which, while seemingly insignificant, were used as leaders to glean ideas which might be useful to others, particularly in reference to the work of the infirmary.

Dental colleges in this country have operating rooms both large and small, containing from nine hundred and sixty to ninety-six hundred square feet, averaging from forty-nine to one hundred and fifty square feet for each operating chair. The shape of the room is usually rectangular, which seems to afford better facilities for light, unless situated at the top of a building and lighted also by skylight, when a square room is simply ideal. About two thousand chairs are in use in our dental schools, ranging from nine to one hundred and fifty in each, and used by seniors, juniors, and freshmen. With the exception of one, all schools allow juniors to operate, and one-third of our schools allow freshmen to do minor operations, such as the cleaning of teeth, etc. In a few colleges juniors have special chairs, one or two have special rooms for juniors, others alternate with seniors, or, juniors operate in the morning and seniors in the afternoon. In all colleges seniors operate, but in some their requirements must be fulfilled in January in order that the juniors may occupy the chairs the remainder of the session. This indicates a system of doubling which is *not* ideal. We believe that seniors should operate during the entire year, and each day in the session. While our colleges have chairs equal in number to but two-thirds the number of our seniors, careful management would enable each and every senior to have daily practice. An increase in the number of chairs in some colleges would make this method practical. Those in charge of the operatory find the numbering of chairs a great assistance. In our own school, where every senior retains his chair throughout the year, we have placed on the wall before each chair a neatly printed card containing the name of the senior, and patients often save time by inquiring for the student by name. In our opinion, juniors should operate, but admission to the operatory should be governed by the completion of their work in prosthetic and operative technics. Freshmen should not be allowed to operate.

Attendance in the operatory may be kept by the clerk or demonstrator, roll call, noticing absentees, attendance cards, which may be handed in to the clerk with student's own signature, or by attendance cards, punched by the demonstrator in chief. The amount of work accomplished, and not attendance, is the requirement of some colleges. The principal requirements of the operatory consist in the filling of teeth, their treatment, minor oral surgery, and dental orthopedics.

Most colleges require a certain number of fillings ranging from six to one hundred gold, six to fifty amalgam, five to fifteen cement, five to ten gutta-percha, and no more than fifteen tin fillings are required in any one school. Many schools do not require any tin fillings, which is, we think, a grievous mistake.

As a further requirement, treatment of abscesses, pyorrhea alveolaris, gingivitis, and a limited number of cleanings of teeth comprise the list. Satisfying demonstrators of their ability, or requiring students to do all they can, without limit, are methods pertaining to seniors in some colleges. One of the best systems devised for regulating the minimum amount of service in the operatory is known as the "Count System," devised, I think, by our esteemed Professor Black. It is based upon the value of "points." The simplest kind of a cavity filled means one point. From one to fifteen points can be gained by the operator in a single operation. To illustrate further,—approximal cavities in incisors and cuspids count from three to five points, occluso-approximal cavities in bicuspids and molars from five to eight points, and so on, increasing as the case merits skill and labor. The operation in each case is passed upon by a demonstrator, who issues cards to the students, which must be handed to the clerk of the clinic before credit is given for the operation. The full number of points required of the senior students in one school is one hundred and twenty-five in gold fillings and one hundred and twenty-five in amalgam. For the juniors, sixty-five points in gold fillings and sixty-five in amalgam. In another school two hundred points in gold and fifty in amalgam are the requirements for seniors. Fillings of other materials are gauged by number rather than by points.

A diversity of answers was received concerning our query as to how to prevent waste of materials. "Would like to know" and similar replies were given. One college provides bottles for the waste gold, and another deals it out in small pasteboard boxes, which are returned to the clerk with the remnants. Colleges which sell their materials to the students or patients before the operation avoid the waste, but at the same time give the student an opportunity to secure a fee for himself.

Capsules containing from five to ten grains of alloy subserve a useful method to prevent waste of that material.

A very practical economy in the use of medicines has been followed in our school by giving each senior, at the beginning of the year, a portion of each of the medicines most commonly used, he to provide his own bottles. We allow from two to four drams of each of eighteen different medicines, which, when exhausted, must be replenished at the expense of the student. The college medicine case contains a complete variety of medicines, adapted to special cases, which are furnished to the students upon application.

Systematic teaching, with a heterogeneous supply of operating instruments among the students, is an absolute impossibility. Uniformity of sets of instruments, well selected by the management of the college, is a necessity. To facilitate work the instruments should be numbered, so that demonstrators may save time by calling for them by number. They should also be numbered by the metric system, thus teaching form, size, and strength. Another advantage in the metric system of measurements of these instruments lies in the student's ability to secure exact duplicates from the manufacturer.

The extracting and surgical clinics are most frequently neglected, graduates often having had little experience in this important department of learning. To accomplish the teaching in this department satisfactorily, classes should be divided into sections of not more than three students. Each section does duty upon date of its assignment, and all cases presented during its service are property of the section.

By all means a skilled demonstrator should supervise this work, and no case should be operated upon unless he is present. In this way *only* can systematic instruction be given in extracting, surgical cleanliness, preparation of local anesthetics, and the use of general anesthetics.

An examination room, says one of our best teachers, is a necessity. It prevents interference with students who are engaged in operating, and it serves to facilitate matters.

Let me suggest that students, in rotation, perform this service as examiners in connection with the demonstrator, this service to constitute their whole duty on the days of their assignment. Provide a special examination chart to be filled out and duly attested before his demonstrator, which will also serve as a guide to the student to whom the case is assigned. This plan is now in operation in the college with which the writer is connected, and is meeting with much favor.

The assignment of patients is one of our greatest problems. This is done alphabetically, according to matriculation, according to the amount of work performed, according to the ability of the student for that special work, by the available students, and to those having the fewest counts. The work of assigning patients is performed by the superintendents of the clinic, or by demonstrators in whom should be embodied keen perceptions and acute intuition with enough strategic ability to keep the students in touch with their work. One experienced demonstrator can handle ten students entering the operatory for the first time, providing he has no other duties to perform, and, as their experience increases and they require less constant attention, he can increase the number to twenty-five.

In former years classes were more variable, but now flexibility toward the great purpose of our work is increasing, as higher requirements are made for entrance to our colleges.

Mention of the methods of keeping records of our work has been purposely omitted from this paper, because they can better be studied by a perusal of the various charts which have been mounted upon cards and placed among the technic exhibits. From these we can all see which method most fits the needs of our own school.

It affords me great pleasure to thank the various officials for their courteous attention in replying to my letters of inquiry, and I trust that the seed they have sown will bear excellent fruit, that the work of the operatory will increase in usefulness, and that through our conscientious efforts to systematize our teaching we shall elevate our chosen profession and send out into the world good, proficient dentists.

DISCUSSION.

Dr. W. E. Wilmott. Several members have asked me to explain the methods adopted in our infirmary, and I have asked these gentlemen to kindly distribute to you a copy, which I will explain to you in a few moments. This subject possibly is of interest to few of those assembled, but it is not the less important. It is not exactly a method of teaching, but I claim one of the minor objects of the association is to teach the students methodical methods and ways of doing things. If our laboratory is carried on in a careless, slipshod manner the student becomes so himself; but if we have a system it is a good thing for the students.

It is surprising to know that some schools count the amount of work done, and not the attendance. I think that is a great mistake. There are students who work with the idea of doing the least possible work in the least possible time. A student should be compelled to be in the operating room a part of every day at least.

I have nothing particularly new, but I hope some of you may get some ideas from it. I have been improving for ten years, from time to time, but I realize it is anything but perfect. Our idea is that the keeping account of material, etc., should be as light as possible for the demonstrator. This is a description of the methods employed in the operating room,—the dispensing of the supplies and keeping account of them, and the manner of keeping account of the value of the material used.

(The speaker had a card showing the means by which an account of the materials used, etc., was kept for each student. The manner of using the card was fully explained by reference to it.)

Dr. D. M. CATTELL. I am a believer in system, too. I do not like the word "infirmary." It is in the profession, however, and we cannot very well overcome it. (Making illustration) Infirmary consists of operatory department, prosthodontia department, orthodontia department, crown and bridge department, surgery department, etc. There you get my meaning. I do this because a member asked, Why "operatory"; why not infirmary? *Infirmary*, it seems to me, includes the whole clinical department, so to speak, of our colleges, and that department might be subdivided into operating room, prosthetic room, orthodontia room, crown and bridge room, and so on. I agree with the writer of this paper, and I have no special criticism to offer on the paper at all: but it does not take in the scope I had supposed it would. I am very much disappointed in it in that regard, because I had hoped that the writer would formulate a system, somewhat ideal, to present to us at this meeting. I agree with the paper that no student should be allowed in the "operatory" until he has finished his work in the technic department, whether senior, junior, or freshman. In the clinical department I like to see an appointment book properly kept, just as we have it in the office; and in that appointment book the patient's name, the hour at which the patient is to be received, and the operator that is to meet the patient. In regard to material, we should sell the material to the patient, not to the student; the student acts as agent between the patient and clerk, after the demonstrator has passed on the cavity. At that time the demonstrator indicates upon a little "material card," by writing in figures or otherwise, the number of rolls of gold or other material that it will probably require to fill that particular cavity. We use No. 3 gold, college rolls, so called. That is, each sheet is divided and made into three rolls, so that if a cavity requires seven or eight rolls, that amount is marked on the material card, and the patient knows how many rolls are required to fill the cavity. The operator tells the patient the price per roll, and the patient pays the operator the money, who carries it to the clerk and buys the gold, carrying it to the chair in a special box, the patient knowing exactly how much gold has been bought. At the end of the operation, if there is any gold left it is returned in the special gold box to the clerk, who refunds money prorated in fifths of a roll. When through, whether there is any left or not, the box is returned to the office. All scraps of soiled gold are dropped into the box during the operation and returned to the office. We have in the Illinois School of Dentistry so far this year made a considerable saving. We have received quite a little bit of soiled gold. We had no idea there would be so much returned.

The classes are divided into four sections, both for operating work and extracting; one section coming on one day, and another the next, so that one section never comes repeatedly on the same day of the week. However, that does not deprive the students in other sections from doing work if they have it to do. But the section for the day receives all the new patients that come on that particular day. We do not assign to students a particular chair for the week or for the day, but any chair that is vacant he may select; and the chair with certain space around it is for the time considered his office, and he must treat is as though it were his private office. He must watch that no soiled paper or rubbish of any kind is thrown around, and if it is dirty when he takes the patient to the chair he must see that it is put in order before he begins work; and he should act as though the patient, chair, space, and money coming was for his private and special benefit.

Years ago dentists had examination blanks in their offices. I think if you were to travel over the country now you would find very few dentists who used examination cards or blanks. They are somewhat of a dead stock in supply houses, and only used to-day in dental schools for other purposes, with probably few exceptions. I don't believe in much red tape, circumlocution, or whatever you wish to call it. I think the more simple the system for demonstrators and students the better. We simply use these charts that you are all acquainted with (exhibiting), and as the work is done the student writes the date, patient's name and address, and designates on the chart the particular tooth or cavity in pen or pencil; then writes near it "gold," "amalgam," or otherwise, as the case calls for. This is all done by the student, who also signs his own name. The demonstrator, before the patient is dismissed, examines the case finally. He has seen it many times during the progress of the work; then he determines what that filling is worth in points, one, five, eight, or ten points, whatever it may be; and, as the paper indicates, the greater amount of work and the more difficult it is, the greater number of points may be allowed. If it is as perfect as we would expect a student to do, he should be given the benefit of the full number of points allowed. It requires but a few moments' time for the demonstrator to look after these "credit slips" and sign his name thereto. That record is passed to the clerk by the student, and filed away until a certain night of the week, when that demonstrator goes over them all in this manner, marking it in a book (showing on blackboard):

STUDENT'S NAME.

Pts. gold..............................
" amal. ....
No. Tin fillings.......................
" Cement fillings..................
" Gutta-percha fillings..............
" Cleanings ....
" Extractions ....
" Treatments ....
Etc.

Dr. TAFT. When does this record begin?

Dr. Cattell. At the beginning of the term. Of course, in the beginning a student may not get a credit of more than five points, where after a while he might receive eight points on a filling. Eight points is the highest one can receive on a filling, except it be, as this little book of rules will indicate, a case where the interproximal space has been lost and he has to wedge the teeth apart and restore that interproximal space; then he is allowed as high as twelve points. The demonstrator may allow, in his mind, say, on a filling six points at the time the filling is inserted. In the polishing of that filling, if the student has destroyed the point of contact, one-third will be taken off the original count.

Dr. Hoff. Do you make the final decision on the number of points?

Dr. Cattell. After the student has made the number of points required in gold, it is at his own option whether he does further work.

Dr. Hoff. You put no restraint on him in the number of times he attempts to accumulate that point. He can make a hundred fillings, and you say the maximum is eight for each filling?

Dr. Cattell. If at all passable, the minimum number of points, one; maximum, eight points. Some classes of cavities filled are worth more in points than others. Simple cavities, few; complex, many.

Dr. Hoff. You allow him to work until he accumulates a number of points sufficient to pass him, regardless of the number of attempts he makes?

Dr. Cattell. He must make a hundred and twenty-five acceptable points, whether he accumulates them in small figures or large. It is the *points* that are counted, not the fillings. The more difficult the operation, the greater value it has in points.

Dr. Hoff. Then I don't think the system a just one.

Dr. Foster asked for suggestions as to how to prevent students taking patients to their rooms and operating on them there. He stated he had had trouble in this respect, and desired information as to some means to prevent it.

Some one suggested that the way to prevent it would be to expel those who did it.

Dr. Whitslar then closed the discussion as follows: I am in accord with Dr. Cattell in being disappointed with the paper. It is not what I expected to write. I procured from fifty-five colleges reports from only thirty-five. If I had had reports from all it would have been very different, and could have made a composite system whereby all colleges might follow its use. We have large and small colleges. What will apply to a large college will not exactly apply to a small one. But I feel quite amply repaid for the time and work in looking after this matter in procuring these little charts we have about the room, because some of them present very valuable features. The chart of the Illinois College is excellent, and worthy of the closest scrutiny. The charts of the University of California and the Minnesota College have some fine features.

THE USE OF TEXT-BOOKS IN CLASS WORK.

By OTTO ARNOLD, D.D.S., Columbus, Ohio.

We have for consideration to-day the subject of books; not, however, under their usual significance as means of information, culture, or recreation, but as technical tools used in our educational institutions.

To the "Century Dictionary" I am indebted for the following definition of the term technics: "Things pertaining or relating to the practice of an art or science." Under this definition books, in an eminent degree, become technical instruments, and their proper use therefore as pertinent a subject of inquiry in this assembly as if they were composed of steel instead of ideas represented by printers' ink.

This taken for granted, I shall proceed to a discussion of the advantages arising from the use of text-books in class work, believing the method to be in accord with the theories of pedagogics which represent the foremost thinkers of the age, and the one which results have shown to be most practical in our best schools.

All colleges unite in placing standard text-books in the hands of their students; the only question at issue is how best to transfer the contents to the brains of their owners.

In the institution which I represent we have adopted the recitation plan in preference to the method generally known as the lecture system, believing that in this way we obtain a more thorough preparation by the student principally through the instrumentality of text-books, lists of which are furnished by the authorities of the school. But just here I wish to put ourselves on record as not depending upon text-books alone, least of all upon any one text-book; that would be to make shipwreck upon the shoals of Scylla after having safely shunned the whirlpools of Charybdis.

"The proper combination of oral teaching and book study," says a noted lecturer on pedagogics, Professor E. E. White, "is one of the profound problems which confronts the teaching profession of to-day." Some strongly advocate one theory, some are firm believers in the other, but on the whole the wiser ones agree that both are absolutely necessary. Goethe's aphorism declares that "thought expands, but lames; action narrows, but intensifics," and we must neither *narrow* nor *lame*.

What, then, are the advantages in the use of books in class work, and what are the best methods for bringing this about? In the first place, the use of books in all instruction is natural and customary to the age in which we live, and to neglect the value of this powerful "fourth estate" would be "worse than a crime; it would be a mistake." In the days of Homer legends and songs were transmitted unchanged for generations, but who on that account regrets the invention of the printing press?

It has been said that if the Bible had been blotted out of existence it might in comparatively modern times have been reproduced from the memories of the devout Scotch Covenanters, but such feats of sound reproduction will never be heard in the dawning twentieth century unless by the aid of the phonograph. *Visual* images are the ones most readily recalled by the majority of people. Sight is sometimes called the regal sense, and Thoreau even said, "Of the five castes, sight is the Brahmin caste." If this is a scientific fact, advantage should be taken of it. Repetition is another factor in impressing details. To a sluggish student, hearing a fact once may not be sufficient to fasten it in his memory, especially as his attention is divided between listening to the argument and jotting down notes for future examinations, while the same student may doggedly pore over his text-book until the meaning becomes clear. Then, if the student misses a lecture it is irrevocably lost under the lecture system, while under the recitation plan it may be partially bridged over by keeping up the connection in the text-book. Yet we do not find, even with this possibility, that absence from class is increased by the recitation plan; on the contrary, its use makes attendance almost obligatory, as unexcused failure to respond means zero upon the record. *Attention*, also, is naturally increased if one wishes to make a reasonable showing before his fellow-students; so, with a gain in *attendance* and *attention,* we claim two powerful factors in favor of our system.

When it comes time for a review the regular manual, with its comprehensive summary, is much more to be depended upon than random notes, often inaccurately taken and poorly preserved.

There is also much more likelihood for preparation when a student is responsible for a certain assigned topic upon which he may be called for discussion, and his actual standing in his class thereupon dependent. Day after day, "no day without a line," he goes on, and at the end of a three or four years' course the whole subject has been passed over. One step at a time seems slow work, but it is the universal law of human progress; and if a pupil has the slightest degree of earnestness his text-books will stand as mile-stones to mark his advancement, and will form no small part of his practical capital for future use.

But it is evident enough by this time that the main use of the text-book by the pupils is outside the class room, to prepare them to enter intelligently into the discussion of the topics assigned.

"Learning is the result of self-activity," should be blazoned on the walls of every educational institution. Only can the house be built by the teacher when the foundation has been prepared by the pupil himself.

"The recitation plan" is a very flexible title, meaning any and all means of presentation in which the student bears an active part instead of being a passive listener. This may take the form of questions and answers, illustrations, practical demonstrations; even, on occasion, the recitation plan may be set aside for the time being and an extemporaneous or carefully prepared lecture may be given. All this is instruction, and in all cases falls upon the best ground when the subject has been carefully considered by the conscientious use of a text-book to familiarize the learner with technical terms and general principles. In the class room mistaken conceptions are corrected, a thorough revelation of each one's standing disclosed, and delinquents reported before reformation is too late. In short, by this means pupil and teacher come into much closer contact than is possible under any other system.

This brings us to "the other half," the use of the text-book in the hands of the instructor, upon which much of the success of the whole matter depends.

He first makes a careful survey of the whole field, laying it out roughly, according to the number of recitations at his command, eliminating all portions covered by other chairs (for few of us now occupy a whole settee, as did at one time Oliver Wendell Holmes). He will give attention to *proportion* in considering the claims of the remainder for consideration. A good teacher will omit from or insert portions into and rearrange *any* text-book, no matter how excellent, according to his own individuality and the characteristics of his pupils. Then comes the assignment of the lesson, a very important part of the work; to give just as much *and no more* than can be readily digested at one sitting. After this, and still more important, is the daily and specific preparation on the part of the teacher. No one can omit this and keep his own interest, to say nothing of that of his hearers.

The subject must come fresh from his mind, though taught scores of times. In fact, "the barrel" is the greatest stumbling block in the path of the lecture system; a danger not so peculiar to the recitation plan, where every answer tends to sway the current of thought. Then comes the summing up, when the use of the text-book is revealed on the part of both pupil and instructor. The skillful leader will sift out the essentials of a chapter, omitting matters of small importance, comparing, condensing, elaborating, illustrating; *this* is, in short, what we consider using text-books to the best advantage, and one that is growing in favor in all schools that have given the subject the consideration which it demands.

"There has been much discussion," says President Eliot, of Harvard University, "about the comparative merits of lectures and recitations. Both are useful; lectures for inspiration and guidance, recitations for securing and testifying to a thorough mastery on the part of the student of the treatise or author at hand.

"Recitations alone degenerate into dusty repetition, and lectures alone are *a useless expenditure of force. The lecturer pumps into sieves.* The water may be wholesome, *but it runs through.* The discussion about lectures and recitations has brought out some strong opinions about *text-books and their use.* Impatience with text-books and manuals is very natural in both teachers and taught. These books are indeed, for the most part, very imperfect, and stand in constant need of revision. *But it is a rare teacher who is superior to all manuals.* Scientific manuals are, as a rule, much worse than those upon literature, language, or philosophy, *yet the main improvement in medical schools during the last twenty years* has been the addition of systematic *recitations to the lectures which were formerly the principal means of instruction."*

Finally, one important influence which we must not overlook, though an indirect one, is *the habit of using books* as aids in professional study, a habit of tremendous importance in determining the mental status of the graduate in his whole future career.

The art of mastering the printed page, like that of all other arts, depends upon diligent practice; in fact, can be acquired in no other way. Some educators declare that in the present prevalence of oral teaching in the city schools the decrease in the power of book study is readily perceived. If this is the case, there is indeed a loss, and one which we can ill afford to suffer. The man who can lay his hand at will upon his scientific authorities, as a soldier upon his trusted weapon, is armed in advance for many an unexpected emergency which would otherwise result in mortifying defeat. Garfield's famous definition of a university has often been quoted: "Myself at one end of a log and Johns Hopkins at the other end." But may we not also speak a word for the firelit cabin in which Abraham Lincoln graduated, where he and his book were both at the same end of the log?

We have not exhausted the possibilities of the subject assigned us, but enough has been said to indicate what are to us the manifest savings in time and energy in the use of a comprehensive, clearly-written text-book. We do not use this as an oracle or inspiration, but simply as a guide-book, a Badaeker, if you please, to lead us in the general details of our journey and spare us time and needless labor. We may not wish to stop at all the points he indicates, and may linger where he expects us to make only a day's visit, but on the whole we greatly rely on our wise counselor, and gladly put ourselves under his guidance, satisfied that, though the way is long and the journey sometimes wearisome, the direction at least is right.

SYMPOSIUM ON TEXT-BOOKS.

PROSTHETIC DENTISTRY.

BY DR. I. N. BROOMELL, PHILADELPHIA, PA.

I take it as my privilege in occupying a portion of the time assigned me to make reference to that which is good, bad, and indifferent in our text-books on prosthesis; to uphold the good, to condemn the bad, and plead for the indifferent with a hope that it may be better. Correctly defined, a text-book is one containing the general principles of a given subject primarily designed for students. A student, in the general acceptation of the term, is one devoting his entire time, or nearly his entire time, to the study of some special branch of science or art. Literally, all who study are students, whether the application to books be made within the walls of an organized place of learning, at home, in the office, or on the street. In the first class we recognize the *bona fide* student; in the second the graduate, the practitioner. There is but little doubt that dental text-books, particularly those which obtain to operative and prosthetic dentistry, are prepared with the idea of meeting the demands of the actual student, and I shall so treat the subject. In one particular our text-books on prosthesis are of about equal value; that is, in the scope of the work, in the "table of contents." Here we find a short treatise on metallurgy, the methods of applying and generating heat, a chapter devoted to the preparation of the mouth for an artificial denture, the materials used and the methods employed in taking impressions, forming the cast, the making of die and counter-die, the mounting of teeth, the use and management of plastic bases, crown-work, bridge-work, etc. These subjects, with possibly a few others, appear to furnish a foundation sufficient in most instances to result in a book of no mean proportions. In this respect, therefore, there appears to be but little cause for complaint, unless perhaps it be the disposition to augment the volume by the introduction of those chapters that might to better advantage be taken up by works specially devoted to the subject, included in these being metallurgy and the preparatory treatment of the mouth.

The marked advance in the teaching of prosthetic dentistry in the last few years certainly cannot be measured by the number of text-books on the subject, for at the present time they are quite limited in number, and those most recently published being one of a series of volumes intended as a systematic treatise by various authors covering the whole domain of dental practice. It is a question as to the best methods to pursue in the compilation of text-books. That is, should they be largely the work of an individual, or the result of the combined efforts of many? In the first we must recognize the disposition for the book to be unduly devoted to the methods and principles most respected by the author; in the second, while the various subjects are contributed by different writers, there is a possibility, if not an inclination upon the part of the editor to so revise and rearrange the subject-matter thus contributed that the completed volume throughout appears almost as coming from the pen and the mind of an individual. Again, it must be recognized that those who have devoted much time and labor in a special direction are best suited to treat upon their specialty; but in many instances, particularly in prosthesis, those who possess a valuable working acquaintance with most operations in detail have not the qualification of communication to others in a clear and comprehensive manner the secret of their handiwork.

Again, in the former instance, the one-man book if you please, the author may be possessed of great volubility, which accommodating faculty, although a happy one in many ways, does not always result in a book full of good things. In such a work one is compelled to read much to obtain little.

Still another class is that in which the author lacks both volubility and composition, the inevitable result being a book abounding in citations; quotation marks being strongly in evidence.

Of these two evils, however, the latter is much to be preferred, for by a careful compilation of practical ideas from practical men, recorded as originally communicated, a valuable and useful production will result.

Now let me refer to some matters pertaining directly to our text-books on prosthetic dentistry. In the first place, this branch of dental training could be greatly improved by the introduction of a work the character of which might be included within the title "Prosthetic Technics." My reason for offering such a suggestion is as follows: The present works upon this subject may be said to pertain to the principles and practice of prosthesis. In these we find a systematic treatise of the subject, a treatise covering both theory and practice in minute detail. Such a book is well adapted to the advanced student, or even to the practitioner who desires to become thoroughly conversant with a given or with the general subject. For the beginner such a book is too voluminous, too much reading being required to obtain the desired working details. It might be suggested, therefore, that the gradation of books be in keeping with the gradational nature of the work, the ideal book for the beginner in prosthesis being one which adheres strictly to technical procedures, avoiding all that might tend to confusion and complication. Such a work might be classed as the intermediary between the compend and those standard volumes at present in use, and might be so arranged that it could be utilized in class or section instruction, serving as a working guide, and carrying the student step by step through his entire technical course.

With reference to the modern books on dental prosthesis, too much cannot be said in the way of praise for the admirable illustrations with which they abound. A written description, however carefully prepared, is necessarily more or less imperfect without the aid of illustrations to assist in carrying out the theme. It has been inferred that in very many instances text-books suffer from over-illustrating. However this may be in works of a general character, it can hardly be applied to those devoted to mechanics, for the foundation of all that is mechanical lies in diagrammatic delineation; therefore there is no branch of dental teaching in which the illustration serves a better purpose than in that under consideration. I desire to refer to the disposition to overwrite certain subjects of minor importance to the detriment of those of much greater significance. A proper judgment in this respect must be looked upon as one of the keys to success in book-making.

In conclusion, I desire to call attention to the many complications and misinterpretations that accrue from what may be considered a lack of attention to our nomenclature. In this the writer has no choice, the nomenclature itself being at fault.

There is probably no other descriptive term more confusing to the student than that used in describing the depression formed on the palatal side of a plate, and variously named a vacuum chamber, an air chamber, or a suction chamber. Practically this is of little importance, but theoretically it causes no end of trouble to the teacher. To remedy this, however, we must first decide as to the nature of this cavity when in the mouth.

Another is that which refers to the coming together of the teeth, both occlusion and articulation being used to describe this process. The terms cast and model are used synonymously when referring to the plaster form produced from an impression of the mouth. While it is doubtful if either of these expressions is literally correct, the latter term, "model," is undoubtedly the most acceptable, especially when we consider that the former term, "cast," must be used most appropriately to describe the act of running fused metal into a mold. To them might be added other terms used synonymously, many of which are entirely misapplied.

DENTAL PATHOLOGY.

BY DR. A. H. THOMPSON, TOPEKA, KANSAS.

The old-fashioned, heavy, padded text-book, like the old-fashioned, heavy didactic lecture, must go. It will soon be relegated to the limbo of things obsolete and useless. It is not in harmony with modern methods of teaching, nor with the changed conditions of modern dental education. A mass of wordy matter is offered to the student that is too often irrelevant or indirect and diffuse, so that he is confused and misled, and fails in his efforts to extract the kernels of facts from the mass of chaff through which he must wade in his search for knowledge. The student reads and studies these heavy text-books, and often very faithfully, but comes to the class-room with very vague and imperfect ideas of the subjects treated of. There is a want of the elements of conciseness, simplicity, and directness in our text-books, which are so essential to ready learning.

The ideal text-book of dental pathology, and of every other branch of our curriculum, for that matter, should deal with that one subject alone, and nothing else. Why, for instance, should a text-book on dental pathology be padded out with chapters on general anatomy, dental anatomy, physiology, and materia medica? But the merest general outline of these extraneous subjects is or can be given, and these are treated in a better and more thorough manner by books devoted especially to them. The condensed account given of these outside subjects is of no use to the student, for he has special books on them; or it sometimes has the bad effect of causing the lazy and illiterate student to think that these brief chapters are sufficient for the study of great branches. Besides that, these other subjects are not dealt with to any extent, or should not be, by the chair of dental pathology. The lecturer and teacher of dental pathology has quite enough to do to cover his field, if he does it at all well, without dragging in subjects which are more fully taught by the special teachers of those subjects. The text-book of dental pathology should deal with that subject alone, and nothing else. One book for one subject. Leave other fields to other special books by specialists upon those branches. The work will be better done, and the general smattering on general subjects avoided.

Of course the ordinary heavy text-book is made to sell, without much regard for the requirements of the student. The author is often induced to expand his material "a little more," so he drags in irrelevant subjects to make extra chapters to pad it out. So what should be a two- or three-dollar book is expanded to a five- or six-dollar book, in order to sell for more cash. But, as a matter of fact, this is a mistaken idea, for as a commercial venture the smaller book would be more profitable. Five or six students will buy a two-dollar book where but one or two will buy a six-dollar book, so that the smaller would really pay better than the larger book.

The next requirement of our ideal text-book would be that each chapter should have questions attached to it which are answered in the text, like some school books. These are excellent helps for self-examination by the student, for quizzes, and for the teacher for recitation and for examinations. As the quiz supplements the lecture, so the questions to the chapters supplement the text, as after helps. They furnish a constant review of the subject that the student applies all the time, and avoid the use of that abomination of the teacher, the quiz compend.

When we attain the ideal method of direct recitation by the scholar, instead of the old-fashioned didactic lecture, such questions will be indispensable in our text-books, as they are in the regulation text-books of our preparatory schools and colleges. Let us hope that our text-book writers will adopt the plan of adding questions to their chapters for these purposes.

The text-book of the future must be small, say two hundred pages, or, at the most, three hundred, and must be concise, simple, and elementary. The average student comes to us with little experience in systematic study. Very often he has been out of school so long that he has lost all of the habits of study that he ever did have. Some are advanced to years that make study doubly hard, because the impressible years of youth are passed. For these classes of students our text-books should be elementary and direct, and as little diffuse and argumentative as possible. Students must be taught as children, beginning with the simplest things, for little preliminary knowledge of our sciences can be presumed. The acquisition of knowledge by the average dental student is a painful process at best, so that it is manifestly cruel to impose on him the necessity of wading through a mass of material that requires years of experience to study discriminately. Of course, the larger text-books are necessary for the advanced student of specialties, but not for the beginner. Therefore, we make the plea for more concise, simple, and strictly restricted text-books for the dental student.

DENTAL THERAPEUTICS.

BY DR. JAMES TRUMAN, PHILADELPHIA, PA.

Were it not that this has been prearranged by the committee, and not a personal selection of a subject, I might very properly be charged with an egotistic assumption of superior knowledge. Having, however, no choice in the matter, I propose to give my views as briefly as possible.

It has always seemed to me that the writers of text-books, with few exceptions, in medicine and dentistry have aimed to make books rather than to impart knowledge. I mean by this that they had in view (1) the size of the book, (2) their own reputation for profundity of knowledge, and (3) in order that this might be emphasized innumerable quotations must be made from authors. The necessities of students are apparently rarely considered.

The minds of those for whom these books are intended are like those of children, presumably receptive, but only capable of absorbing simple problems. To insure this the language used to convey these ideas must be of the clearest character, and be largely divested of technicalities. If the teacher or the author exceeds the measure of the student's capacity to absorb his teaching or his book, the work fails to that extent. The Germans, who have reduced pedagogy to a science, understand this better than most other nationalities. In their teaching they aim to instruct the weakest mind in the class, and the teacher works with this end always in view; and if, at the close of a half-hour's lesson the dull boy has failed to comprehend, the entire lesson has to be repeated, to the disgust of the brighter students.

Now this, it seems to me, should be the rule not only in our classes, but in our books, always writing and talking to the comprehension of the dull reader or student. Text-books, as their name implies, are books to be used for reference by this class of mind; hence there should be a unity of effort between the writer and teacher, and both work in harmony for the benefit of those for whom the work is intended.

Redundancy of words is a positive evil in our text-book writing. It seems to be forgotten that words are tools to formulate ideas. Pages will be taken up with an attempted explanation of the etiology of a subject, and then will follow a maze of words as to treatment, in which the therapeutics are so completely jumbled that the poor searcher after facts lays down the book in disgust. He is met with technical terms in a language unfamiliar, and this at once impresses him with his profound ignorance and with the feeling that he can never master the difficulties presented. Discouraged, he seeks the dictionary, but that fails to enlighten him, for he is met there with obscure definitions, made doubly so by technical terms. By continual repetition the struggler after knowledge may succeed in absorbing the true meaning of the author, but only after a waste of time and energy. Who of us have not experienced a vacuity of intelligence after listening for an hour to a scientific lecture, not understood because the teacher failed to comprehend the first principle of teaching, simplicity of diction?

It is probably true that not one of us, who have devoted our lives to teaching in professional schools, deal with words as we should.

Medical and dental nomenclature is necessarily a very serious study, and it becomes the duty of the teacher, and in this category the writers of books are included, to adopt the method that will impress the idea sought to be conveyed by the word, rather than the word itself. To illustrate my meaning, if I have occasion to use the word "metabolism," and that be used without explanation, almost the entire class would be in a mental fog; but if I were to begin with the changes that this word typifies, and seek to describe and show how these occur in tissues and the formation of new products, before giving the word, it seems to me the idea would be so firmly impressed on the mind that when the word metabolism was given it would be firmly fixed upon the memory. The average intellect must grow into a word. Some grasp these with ease, and are by nature linguists; but these are comparatively rare, and therefore the needs of the majority must be supplied.

The use of foreign words, unless they have been adopted into the English language, should never enter professional writing. The author may be learned in the languages, and be tempted to use a word more expressive than is to be found in English; but its use not only indicates bad taste, but renders the meaning confusing to the average reader.

Another serious evil in book-making is the tendency to embody matter not strictly belonging to the subject the author has attempted to explain, and which could be better studied in books devoted to special topics. Some recent writers have avoided this, but others have not. To illustrate my meaning I allude to one work, that of the late lamented Dr. Garretson, in the mistake he made in his "Oral Surgery" in including "operative dentistry," thus making the book unwieldy and of lessened value.

The subjects included in medicine and dentistry have become specialized, and should be treated with that view constantly in mind; and if a collateral branch must be alluded to, it should be done as briefly as possible. If it be a work on dental pathology it is unnecessary to enlarge on embryology or bacteriology, for these are specialties, and demand exact investigation in broader fields.

In no branch of dental study is there more deficiency manifested than in the therapeutics of our text-books, and to this may largely be ascribed the lack of uniformity that exists in regard to treatment. There is not a text-book on dental pathology that the teacher of that branch does not hesitate to place in the hands of the student. This is not explainable by any lack of knowledge on the part of the writer, but is largely due to a want of harmonious agreement as to methods; and this lack of uniformity runs through dentistry as a whole. There is a certain "go-as-you-please" method that does not add to our reputation as a scientific body. It is not necessary to multiply instances, for they are all around us in our teaching and in our books.

In our therapeutics it would seem that writers take it for granted that students are perfectly familiar with drugs and the uses to which they are applied. This is probably true with the trained reader, but I understand text-books to be written for the use of undergraduates.

Let me illustrate my meaning. If the writer undertakes to describe the treatment of pericementitis, he will probably say of counter-irritation that capsicum, cantharides, mustard, iodin, aconite, terebene, etc., may be applied. No distinction is made as to the difference in properties of these various agents, or to the effect produced, beyond the mere fact that they irritate the mucous membrane and produce new centers of inflammation. My idea would be to take these separately, and discuss their various effects and proportionate values. When a writer says, "Use iodin in pyorrhea alveolaris," why does he use it there? The reader is left in the dark, and feels that its use borders very closely upon empiricism. Is it placed there to excite the glandular and absorbent systems, or is it used for its antiseptic properties, or both? If it be trichloracetic acid, lactic acid, or sulfuric acid ordered upon the same lesion, why is it not stated how these should be used? If it be aconite directed to be placed upon the pulp, and especially upon the peripheral circulation in pericementitis, why not state what is supposed to be effected by this agent in aborting inflammation? Does it act as an irritant, or does it paralyze the sensory nerves, and, instead of producing a desired congestion of the vessels at the new center of irritation, an anemic condition is the result? Does he state, in a word, the object to be attained by the use of these agents?

How many treat pyorrhea alveolaris upon a system based upon its pathology, as far as that is understood? From the descriptions in our text-books the conclusion must be reached that not only is no system followed, but that which is used is frequently injurious, defeating the object of all therapeutic treatment. The true principle, as I understand it, is to treat all conditions presenting. The lesion is rarely the result of a single cause, as in pyorrhea. We have here a phagedenic destruction and a bacterial invasion to be conquered, and the idea that any single application of a drug will accomplish this is a fallacious conception in therapeutics.

This is equally true of counter-irritation. Here is demanded an intimate knowledge of the effect of irritants upon sensory nerves, and the result of the afferent and efferent impulses to and from the nerve-centers. It must be understood, as previously stated, that a moderate irritation produces an increased flow of blood, or congestion of the part, and thus dividing the supply of blood to a given area, relieves the pressure at the focus of inflammation. If, then, powerful escharotics be used, the effect desired is measurably lost by destroying these nerves, together with the vessels expected to receive the extra outflow. This explanation is simply illustrative of what should be taught in the books, as thoroughly as it is supposed to be taught in the lecture-room. I, however, fail to find it there. The result is that our whole therapeutic practice is honeycombed with inconclusive methods.

The same definite description should be used when systemic treatment is indicated. It means but little to say give so much of opium, or its derivatives, or so much of aconite and other agents, or certain purgatives. What the student desires to know is why these are used, and the effect expected to be produced by each. These detailed descriptions may be regarded by some as mere pedantry and beneath the dignity of the author, but if we are to be teachers worthy the name, we must cut loose from traditional methods and make our books and our teachings correspond with the mental powers of those we propose to train. In proportion as we write for the practitioner will our product be lessened in value to the student.

With this view it is impossible to feel that the modern encyclopedic text-book is the proper work to place in students' hands. It is interesting and valuable to the practitioner, but it lacks system, and without system all teaching is a failure. It is true, one mind cannot compass all that is important to teach in dentistry, but one mind can give a thorough description of methods; and if these have brought success to the writer, they may equally prove of value to the beginner, while, upon the other hand, the variety of methods in the encyclopedic form leads to confusion of mind. This difficulty is fully demonstrated in the present methods of teaching in our dental colleges. It is encyclopedic in character; one professor giving his ideas, and another, overlapping in subjects, will give perhaps an opposite view. The practical teaching coming into the hands of the subordinates will there receive another change, the demonstrator having his ideas to inculcate. These antagonisms cannot possibly work for good in the minds of the students. Men go from our schools with a mass of contradictory ideas that require years of experience to reduce to a system. I can see no present remedy for this state of things.

The period of didactic teaching is fast drawing to a close, or at least the time is fast approaching when it will be limited as a method of imparting knowledge. It is possible that it may be used in the future as a means to instruct in principles, but it should not go beyond this. It must be evident that practical details can never be thoroughly taught in this manner. Therapeutics, as well as the other branches of the curriculum, must be taught directly to each student.

This measurably means a change in methods of teaching, as well as of teachers. The traditional custom of appointing professors engaged in practice to deliver a certain number of lectures per week has had its day of usefulness. Men must enter upon this work and leave practice behind. The present mode is detrimental to practice and teaching, neither being wholly satisfactory. The consummation of this is, of course, yet in the future, but it is coming, and when we shall have reached this educational status we will have arrived at my ideal of true education in dental colleges.

ORAL SURGERY.

BY DR. T. W. BROPHY, CHICAGO, ILL.

A text-book is of value to the teacher and pupil so far as it contains matter upon the subject of which it treats in accord with facts established by evidence beyond controversy. Inasmuch as the rapid advancement in the scientific world in which surgical anatomy, pathology, and therapeutics, as well as operative procedure, hold an important place, the text-book on the subject of the oral cavity and parts associated therewith must necessarily be frequently revised or it will be misleading to the pupil, as it will fix theories in his mind which, in the light of more recent investigations, have been set aside. Text-books cannot be dispensed with wholly, and yet I believe many of them are of little use.

Authors of text-books not infrequently write too much. They pad their books to such an extent that the whole volume loses interest, as the really meritorious features are lost in the great bulk of matter presented. The late Professor Garretson was the best-qualified man our country ever produced to write a text-book on oral surgery, but, like many other authors, he made a mistake in not confining himself to the field of his own investigations and practice.

It is impossible for any man to present to our profession a text-book based, even in part, upon opinions not his own or upon a subject with which he is not intimately acquainted, and make such a book popular and valuable to teacher and pupil.

A text-book should present the essentials of the subject upon which it treats; the teacher may elaborate.

A text-book should deal with principles, not with a recitation of innumerable cases in practice.

It is not from the text-book that the pupil gets his most valuable and impressive lessons; it is from his teacher.

The text-book never will be written that can make the profound and indelible impression upon the student's mind equal to that made by the strong personality of a Gross, Pancoast, Agnew, Garretson, or Senn. It is idle, indeed, to compare the magnetic words of these men and the lessons they have taught to the thoughts conveyed by ink and paper. What the average student of medicine, as well as dentistry, requires to equip himself to practice oral surgery is not so much a text-book on the subject as a more thorough knowledge of the underlying principles of surgical practice. Are the students of dentistry to-day well trained in anatomy? Do they do the work in the pathological laboratory thoroughly? Are they trained in the technique essential to the construction of apparatus with which to successfully treat fractures and other injuries of the maxillary bones? Fractures of the inferior maxilla are treated by general surgeons less skillfully and with poorer results generally than any other fractures to which mankind is subject.

The tendency to-day in all departments of school and college work is to use the laboratory and teach object lessons. So in oral surgery the student must, instead of depending on a text-book, *not only* know descriptive anatomy, but he must know surgical anatomy as well; and the course in the minutia of surgical anatomy of the oral cavity cannot be quickly or easily completed. As an example, the study of the anatomy of the temporo-maxillary articulation is very important to every dental student, and more especially so to those who aim to engage in oral surgery. The text-books cannot impart an accurate knowledge of this most active joint.

Practical study on the cadaver, not only from the standpoint of descriptive anatomy, but of surgical anatomy, and the relation of the important tissues to the articulation, must be fully comprehended if the young man would venture to operate in this region.

Even with all the knowledge obtainable from text-books and from his work on the cadaver, he will sometimes in performing operations find anomalies without precedent, and in the management of which his ingenuity and resources will be taxed to the utmost.

Are the students of our dental colleges qualified to pass well in the department of anatomy? Do they all carefully dissect the tissues, especially of the oral cavity and its associated parts, so as to be thoroughly acquainted with it? Do they dissect out the muscles forming the soft palate, together with the muscles which have relation thereto, that they may know its function and its defects; how, when, and by what procedure, whether surgical or mechanical, these defects may best be overcome?

A text-book is like a guide board at a country cross-road. It points the way, but it does not lead. The traveler may learn from it which way to go to reach the place he seeks, but the board does not inform him of the many curves in the road, of the hills he must climb, of the obstructions along its course, and other difficulties with which he must contend in reaching his destination. He must learn these things by his own hard-earned experience. Whoever would learn to be an oral surgeon must not rely to any great extent upon text-books, but upon work, persistent work; not wholly what he sees others do, but upon what he does himself.

Nor is it work alone that brings success. It is to a great extent the ability of the man to meet emergencies and do things not mentioned in the text-books, nor by his professors, but to meet conditions which arise the like of which he never before heard. In other words, he must be a man not only able to command and utilize the methods he has been taught, but devise and use methods of his own.

In the expressions of the noble Garretson, the father of American oral surgery, under the shadow of whose name and influence this subject must ever be considered and taught, if you would succeed in the practice of oral surgery lay your foundation in anatomy. Upon this place many courses in physiology. Then build the superstructure in pathology; fasten and bind all together with the cement of principles, and a mansion thus constructed will shelter and protect you throughout your professional career. Without such foundation principles you build only upon shifting sand.

DISCUSSION.

The PRESIDENT. I am very certain that we all feel we have had enough given us in this feast to occupy our time for the rest of the day, but we have only half an hour that we can give to the discussion of the papers which have been read, and I will ask Dr. Hunt to open the discussion.

Dr. G. E. HUNT. This session has been one of the most profitable of the meeting to me. The subject of text-books is an interesting one. In my opinion, we need a text-book on therapeutics more than anything else at the present time, although it may be because I teach therapeutics that I think that. I wrote out a few comments on Dr. Arnold's paper which I will take pleasure in reading, and to which I hope you will have pleasure in listening.

I confess I am inclined to favor to a degree the recitation or, to use a forgotten phrase, for which I thank Dr. Webster, the Socratic method. It may be argued that we are teaching men, not children. That is true, but yet the teacher who tries to instill inductive reasoning powers into his class of *men* by the lecture system alone will find that he has failed more often than he succeeds. Results are what we want. In my opinion more results will be obtained by elucidating a point by questions than by a lecture alone. I would not advocate the use of a single text-book in all studies. In anatomy I see no reason why Gray or Morris should not be adopted and adhered to. In physiology Flint answers all practical purposes for the assignment of a lesson. In dental anatomy I use Broomell. But in no other branch, so far as my recollection extends at this time, do I believe that we have text-books sufficiently comprehensive to use without more or less elaboration. In pathology I use Barrett, in connection with the Socratic method; and, at times, supplement these with a short lecture. In operative and prosthetic dentistry, crown- and bridge-work, orthodontia,—in fact all those branches pertaining to the art of dentistry,—we have no adequate text-books nor ever will. Any text-book on these subjects must necessarily reflect the views and beliefs of the writer, must be biased by his individuality. That is not true of the scientific subjects. Dental anatomy is dental anatomy, and whether the text-book be written by Black or White or Green or Brown makes no difference so long as the writer states the facts, and the order of presentation are the only points to consider in selecting such a text-book. But outlining a method of treatment for a putrescent pulp immediately introduced the personal element into the question. We do not then have a known *fact* presented by Broomell, Black, Morris, or Gray, but we have the method which has proven most successful in the hands of John Doe or Richard Roe offered for our consideration,—a very different matter. So that in these studies of the art of dentistry the lecture system, supplemented by the recitation system, is the most efficient method. In the scientific branches where a reasonably perfect text-book is available, I believe the recitation system will produce the better results. We have no text-book in many of the scientific branches that fulfills the requirement. If we had, I would be in favor of extending the recitation system farther than it is possible now to do. The advantages of the recitation system have been elaborated by the essayist, and it is unnecessary for me to repeat them. But before closing let me sum up my statements, that no one will misunderstand me.

1. By the "recitation system" I mean a method of teaching in which the student takes an active part.

2. I believe the recitation system is perfectly practicable and superior to any other method, in teaching the scientific branches of the curriculum, if we have the proper text-book for its presentation.

3. I believe that in some of the scientific branches we have no adequate text-book.

4. I believe that in those branches pertaining to the art of dentistry, it is only applicable to a degree, and must be supplemented by more or less elaboration on the part of the professor.

Dr. W. C. Barrett. Dr. Hunt knocked me out by the resolution he offered the other day. I can never find the end of a string in five minutes. I never want to make my first speech in the second one. Some of us remember what Dr. Thompson used to say,—that any one who used a text-book was unworthy of the name of teacher. I do not quite agree with that, yet I think we use text-books too much in our practice. If we use text-books at all it must reflect the personality of the man who teaches. The teacher who tries to teach and does not impress his personality upon the students is not fit for a teacher. He may teach wrong; better do that than not teach at all. You take exception to that. I mean within certain limits. I don't mean to teach falsehood, but that he should teach principles badly better than not at all. He must impress his individuality upon the students. The text-book is useful as a statement of principles, truths, axioms, which are perfectly arbitrary in their character. You learn the multiplication table from the text-book, but you don't learn how to use it in your business. In anatomy a text-book is absolutely essential, because you must learn a description of the bones; but without the bones themselves a text-book may entirely mislead you, and you can have no conception of their form any more than sight can give an idea of harmony. A text-book, then, is limited in its application; exceedingly limited, especially in matters that depend upon experience and observation. In many cases the text-book is a delusion and a snare. Hence, in my opinion, nothing will ever take the place of lectures. Nothing can take the place of elucidation of principles by the teacher himself. The principles which it enunciates are not applicable here, and must be qualified there. There are so many accidental incidents which enter into the problems, and must be considered in proper relations. The text-book can consider but one at a time, and so I say the text-book at times is a delusion and snare. In treatment of alveolar abscess, or any other pathological condition we can conceive, the text-book lays down certain rules. It says a counter-irritant should be used, but there are so many. It may be that tincture of iodin may be indicated for treatment, but there may be other features present which absolutely countermand the use of it, and you must use something else. Hence the text-book which cannot explain the circumstances, which cannot teach students to sum together the different features, add them up and group together all the symptoms, and from the sum of the whole arrive at a conclusion as to what is proper,—I say if it does not do that it cannot teach properly; and the text-book cannot do that. Hence I feel quite antagonistic to the idea which is being urged at the present time, that we should make greater use of the text-books, and that we should eliminate the lecture system and substitute text-books and recitations. I think the idea is all wrong. It is perfectly useful in teaching mathematics and anatomy, but will not answer for pathology and therapeutics.

Dr. H. A. Smith. There is just one point in Dr. Truman's paper I want to call attention to. I understood him to say the better teacher was not necessarily a practitioner. It seems to me the man who is in touch with dentistry as a practitioner is the only proper teacher. At the same time, the teacher too often comes before the class a used-up man, having worked in his office all day. He should give his best services to the class, and that would be after a night's rest, before he goes to his office at all. Professor Abbott told me once he practiced dentistry all day until half-past four, then walked to the college and lectured from half-past four for perhaps an hour. With all his vigor, with all his determination, he was not doing his class justice, was he? If he had gone to the college in the morning and then to his practice, he would have done his class more justice, but then he would not have done justice to his patients. I believe a man who lectures should take a rest between lecturing and office practice. Formerly we had a lot of professors who came when they pleased, and they were not good teachers for that reason, teaching after working all day. We try to pay them now, and have them in the morning, while they are at their best.

In the treatment of pyorrhea alveolaris which was referred to. If there is anything in God's earth the treatment of which is confusing, it is the directions given for the treatment of that; nobody but an experienced practitioner can teach such treatment, and so of many other disorders. So I say only a practitioner is a fit person to teach even anatomy, or any other subject in the curriculum.

Dr. A. E. Webster. Judging from the remarks and the papers, it would seem to resolve itself to this, that it is mental training we want. You don't need to go into detail with a man who has a cultivated intellect. In giving instruction in infirmary practice, never tell a student what you think until he makes a statement for himself. If you do that you have given him a training, and that is what he needs. It is a question of judgment, and if we can make our training so as to cultivate the judgment of the student, making that the idea from the very first day, and so on until the student goes away, we should have no trouble. The student should acquire such mental training that he can determine these things for himself.

Dr. G. H. WILSON. There is one thought I would like to speak of in connection with this matter of teaching, and it is an argument against Dr. Arnold's position; and it seems to me a strong one. It is this, that we express our ideas by words. Some one must use the words. The great object of class teaching is to have the class instructed, not one individual. Now, who can express the idea better, the student who is to be instructed or the professor? If you say the student, then you must say he should be the teacher.

Dr. WEBSTER. I want to say the student is the teacher. That is the point. Make him the teacher. That is just where I differ with the essayist.

The CHAIRMAN. In what sense is he a teacher?

Dr. WEBSTER. You arouse him to action. You must arouse interest. Interest is not a mental act. It is impulse. You must arouse impulse of the mind first, and then after interest comes attention. You cannot make yourself give interest. Now, then, it is a question of ideas of one student from the other, and the teacher back and forth. Have interest, and then you will get attention. Without attention you do absolutely nothing.

Dr. W. C. BARRETT. The teacher is the one who first suggests the idea?

Dr. WEBSTER. I didn't intend to go into that at all, but it comes this way. You must first put an idea in that student's mind before you can put anything else round about it. The idea is only developed by the student acting on it. He builds around the idea.

Dr. BARRETT. Where does he get the initiative?

Dr. WEBSTER. He must have that from perception. It is with himself. He needs development. We go back to the sensation of touch for all things. That, I know, is contrary to all present ideas.

Dr. G. H. WILSON. I think I used the wrong word when I said "teacher." I should have said "professor," or the one who is to impart or stimulate the acquirement of knowledge. If we employ a teacher or professor and pay him a large salary, we shall not be satisfied for him to take a text-book and assign lessons and hear recitations. An assistant of limited resource can do that. But when we pay a man a high price to teach we want one who can bring in all things and give instruction, and not spend time in hearing recitations. He will ask questions, most decidedly.

Dr. W. E. Grant. I wish to say that assistants are of no account at all. They are absolutely of no account. Dr. Webster struck the keynote when he said we must arouse the interest of the student. Ask them questions, and make them answer; and at subsequent lectures question them as to the preceding one. Half of a man's time at least ought to be given to hearing from the students themselves, to see if they have received what he has given them. In that sense the students are the instructors.

Dr. Barrett. That is all very well, but here comes in another point. It depends somewhat on how deep a man's *pond is.* If a man's pump begins to suck air at the end of fifteen minutes, he has got to begin to ask questions. If he is the teacher he ought to be, if he knows his subject thoroughly, he cannot afford to stop to question as a general rule. He should have some one to do his quizzing; not that he can do it as well as the teacher, but because he can give more time to such an exercise. You have an assistant in the laboratory to do the coarse work for you; not but that you could do it better, but you cannot afford to do it, and so with a good teacher.

Dr. G. E. Hunt. I think we are all agreed there should be a combination of the lecture and recitation system. You can bring a point out better by questioning a student on it than by stating it to him.

Dr. H. W. Morgan. I had not intended to speak. I think the trip to Philadelphia has been worth the treat we have had this morning in these essays on text-books, but I cannot understand the trend of the argument here for the class-room system when each and every one of these essayists have agreed that we have no text-books. We must get text-books first, and then we can go to the class-room. That is the first requisite. I am satisfied that these essays will do good. They will be read by the book-makers in the future before they put their books on the market.

I am agreed with the gentlemen who have spoken as to the blending of the two methods. It is a very bright man indeed who can elicit it from a student's head who does not first have it in his own. I believe that the teacher must have enthusiasm. Enthusiasm is that which indicates the degree of authority, because there is always more or less question when we read an article, especially when the work comes from a teacher made along the line suggested by Dr. Truman in his article, men who are not practical men; men who are not in active practice; men who have been doing this thing year after year, and especially along the line of anatomy they have been doing what? Copying errors, as we have learned by Dr. Cryer's work in the last five or ten years. We are to have a revolution through men like that, who go to nature for their facts. We must work on those lines. It is only the worker who can prepare a book and do the teaching.

Dr. J. TAFT. This subject is undoubtedly of very great interest to us all, and it shows that there is a recognition of the fact that improvement can be made in our methods of teaching. And I am glad to see so much interest, because where there is this interest and this feeling about it, looking about for better methods, they will likely be found. If we should rest content with the methods of teaching of former days, the profession would be in a sad condition. We are dependent for progress in these last years on this very question of inquiry.

As to text-books and other means of instruction, books are used because they contain in their pages the experience of the writers. If the thoughts that are presented here to-day should be placed on paper, would they be any the less valuable? Certainly not. Thought which is placed on the page is just as valuable as though it were spoken, essentially, with this exception, that by the spoken words the personality of the speaker makes an additional impression that cannot be made by the written or printed page. Hence, while I believe principles should be presented in the form of lectures, the comprehension of many students can be aided very much by reading, by illustrations of models and drawings; anything and everything of this kind that can be made serviceable in impressing and drawing out from the student his best thoughts. These are all valuable.

Now as to recitation methods. You have a book here used year after year. Did you ever deliver two series of lectures exactly alike? Have you not been gaining all the time more knowledge?

If not, you had better quit teaching. We are learning constantly, and the teacher who does not seek to give to his students the benefit of this growth is falling far short of the thorough teacher. A good teacher will find new material all the while which will be valuable in his work with the students. That places the text-book and the recitation method at a disadvantage. If you follow a text-book two or three years old and bring into it what you have since gained, you remove the greatest objection to the recitation method. My impression is there is no method so good, and that will reach the aspiring, industrious, enthusiastic student as the lecture method. You are constantly adding your accumulating knowledge and giving the student the benefit of it.

I can hardly see the propriety of the method suggested by one of the speakers, that a teacher must stand merely as a pump, and draw out from the student what may be in him. The value of your teaching depends on your own knowledge. Have you no more than the student? If not, where is your superiority? If he has as much as you, how can you help him? If Dr. Webster has the power merely by his presence of communicating knowledge to his students that he possesses himself, it is a wonderful thing. You cannot draw from a student that which he has never had or conceived, and has not a basis upon which to form a conception of the knowledge you wish to give him. I do not think Dr. Webster means to lead astray, but he advocates an impracticable theory which he seems inclined to push to the extreme.

There is one feature that has been left out altogether. Here is a very bright student, comprehending everything you give him at once, ready to take a text-book and make a recitation on it; another student is so dull you have to cram it into him. There is a very great diversity in the ability of students to comprehend what is given them. Men who have been accustomed to mental work will catch the ideas much quicker than one without this training. A bright student is a stimulus and inspiration. How different is the feeling when you see another student half asleep. Somebody said this morning that the students laid down in their seats and went to sleep, and when you wake them up to ask them a question they turn over again and go to sleep. The question is, what shall we do? Some one has said get down to the comprehension of the dullest student you have and work on him. What are the rest doing? This is a problem I have not been able to see through. If we could select for our students all bright, educated, cultured students, whose minds take in and comprehend at once what is given to them, what a glorious thing it would be to be a teacher. But how discouraging it is to take the dull, listless, careless student and endeavor to get it into him by some means or other. Very frequently after repetition you see he does not understand it, and you turn it over and present it another way; and finally you get something into him, but it is exceedingly discouraging.

Dr. WILSON. Do you think it is possible to ask questions of a dull student and draw the knowledge out of him?

Dr. TAFT. I don't think so. If you can't get anything into him, how can you draw it out?

Dr. F. D. WEISSE. I am sorry I was not here earlier. I am delighted with the remarks of Drs. Taft and Morgan. As I understand it, it is the question as to teaching by recitation from lessons learned in the text-book. That is one phase of it. It is my impression and the impression of those with whom I have come in contact that the personality of the lecturer carries great weight. As Dr. Taft said, the lecturer combines in the lecture a great deal of work outside of the lecture. The lecturer combines the mature thought and digestion of many text-books, and the student is not confined to one trend of thought, but the lecturer gives him a concensus of opinion from many authors. I think if students were examined more by the professors it would be much better. It is our method to have weekly examinations, in which the professor meets the class and examines them. He passes around sixty or seventy questions. I can pass around probably sixty in an hour, requiring short answers. Frequently I have the first and second year men together, and if one cannot answer it, the other can. If the second year man cannot answer a question and it is answered by a first year man, that is a triumph for the first year men, and the interest is kept alive. In that way the student is kept in touch with the professor by the questions he asks.

As to text-books, I tell the students in the first lecture how to use the text-book. They work too little with the indexes of their text-books. If you want to work to advantage to get at a subject, turn to the index and find out the page on which that subject is to be found. Find the answer to the question, and when you have read it shut the book. Don't allow the eyes to run beyond that. In that way text-books are valuable.

The CHAIRMAN. It has been quite difficult for me to restrain myself as your presiding officer. I have found it almost impossible to keep still on this subject, because it is one of exceeding interest to me. I know there are others who feel as I do, but our time is limited and we must close the discussion, as the time for adjournment has nearly arrived. I will ask Dr. Arnold to close the discussion, with Drs. Thompson and Brophy to follow him.

Dr. ARNOLD. In writing on text-books, I assumed they were in general use and that they were written for a purpose. I have discovered here that writers of text-books have condemned them. I don't know why Dr. Barrett writes a text-book when he don't expect us to use it.

Dr. BARRETT. I quoted another, not myself.

Dr. ARNOLD. I tried to arrive as near as possible at some plan as to how to use text-books, taking for granted that they were of some value. We must have a foundation to start on. The question came up in discussion as to where a pupil first gets information. He is asked to recite; expected to be a teacher in a certain sense to the rest of the class. I believe with a starting point he might be a teacher to some extent on what he recites, but he must get the foundation from somewhere; therefore I don't see how we can well dispense with text-books. With all their defects we love them still.

The question of bias was mentioned. Is the writer of a text-book any more subject to bias than a professor? Not at all. I think the lecturer may be just as biased in his scientific attainments, and as dogmatic as the writer of a text-book, so I see no especial reason why exception should be taken on that ground. The teacher illustrates and corrects the mistakes that may be in a text-book. Where is the perfect text-book? I don't believe there are any; there is constant necessity for revision. I believe the dental profession uses text-books less than any other profession. I don't see why. We claim to be a learned profession, yet use fewer books than any other profession. I don't think that is quite to our credit. I advocated the combination of oral teaching with the systematic use of the text-book.

Dr. A. H. THOMPSON. The trend of the discussion has not been very desirable. The indication, however, is favorable, in that the desire seems to be toward simplification and coming back to natural methods. We know we must deal often with students who have not ability to understand and comprehend a lecture, and they cannot get it out of the old-fashioned heavy text-books. I think the tendency is very satisfactory, in that there is a desire to simplify and come back to the first principles of scientific methods of instruction.

Dr. BROPHY said he had nothing especially to offer, but thought much more attention should be paid to laboratory methods than either class-room exercises or lectures.

The CHAIRMAN announced the discussion closed, and the next order of business to be that of installing the newly-elected officers.

Dr. Hunt conducted the newly-elected president, Dr. H. P. Carlton, to the chair, and in greeting him Dr. Hoff, the retiring president, said,—

It gives me a great deal of pleasure to deliver into your care and keeping this organization for the coming year. Young as it is, it demands great care in the guidance of its affairs. Although it is young, it is vigorous, and will need skillful direction for the future. I trust you may do more for it than I have been able to do this year. I feel proud to point to this meeting as a result of the labors of myself and *confrères*, and I commend this organization to you for your best thought and care the ensuing year, for what you shall do may mean much to the progress of dental education in this country. You have men to work with who will enthusiastically respond to every call you may make of them, and I commit them to you for your thoughtful care and consideration. Gentlemen, I present to you your new president, Dr. H. P. Carlton, of San Francisco, California. (Applause.)

Dr. CARLTON responded: I thank you indeed for the honor and the confidence you have shown me in placing me at the head of the Institute of Dental Pedagogics. It rests entirely with me now to prove whether your confidence has or has not been misplaced. I believe you will find at the close of the next meeting that it has not. I feel very grateful for two things: First, the example set me by our retiring officer, Dr. Hoff. His course I shall endeavor to imitate. I have for assistants and advisers a most admirable board of executive officers, of which Dr. Morgan will be chairman. No extended address is expected of me now; I shall inflict that upon you at the opening of the next session. I am very proud of the fact that you have elected me presiding officer, and I shall try to prove myself worthy. Gentlemen, I thank you. (Applause.)

The vice-president, Dr. G. E. Hunt, was then presented to the society.

Dr. Hunt thought no speech was required from him other than an expression of thanks for the honor conferred.

The secretary and treasurer, Dr. Goslee, was then introduced, and said: I shall not indulge in any remarks, except to say that I am thoroughly appreciative of the courtesy extended to me in my re-election. I deem it an honor indeed, and shall endeavor to attend to the duties of the position to the very best of my ability.

The meeting then adjourned.

Proceedings

OF THE

EIGHTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics,

HELD AT

NASHVILLE, TENNESSEE,
December 27, 28, 29,
1900.

PREFATORY NOTICE.

The Publication Committee presents this report of the eighth annual meeting without comment or apology, believing that the results tell their own story.

GEORGE EDWIN HUNT,
HART J. GOSLEE,
DAVID M. CATTELL.

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PROCEEDINGS OF THE EIGHTH ANNUAL MEETING OF THE INSTITUTE OF DENTAL PEDAGOGICS.

ADDRESS OF WELCOME.

By Dr. D. R. Stubblefield, Nashville, Tenn.

It affords me a great deal of pleasure to offer some words of welcome to you. In fact, the idea brings me a good deal of satisfaction. But the necessity of attempting to execute it at a moment's notice all but overcomes me. Nashville has been fortunate in many other respects, but this is the first time that her good fortune includes that which we have to-day—the presence of so many dentists who are not only dentists, but are also teachers—men who represent a live and progressive profession, and are the practical exponents of it; men who are engaged in the practical work of making the finished product. I congratulate Nashville, therefore, on having the opportunity of indulging in the deliberations of this body, that is so unique in the world of our profession. We flatter ourselves that whether we are worthy or not, it will be an occasion rich with experiences and bring to us a satisfaction in the way of return that will stay with us.

We hope that your deliberations here will be at least not disappointing. We wish that our facilities were greater and better than even the mark and execution of our desires, but the best we have we give to you; all we have we cheerfully put at your disposal, and I wish to say, as the mouthpiece of my profession in this city, that I declare to you that you are welcome. Now, if you doubt it, put it to the test; ask, and you shall receive just as much as we have to give, and what we cannot give, we wish we had in order to give. So, I say, that in congratulating ourselves upon this happy occasion, we give everything we have to you, and we hope that you will enjoy your stay and profit by it, as much as I am sure we will both enjoy and profit by your coming.

DISCUSSION.

THE PRESIDENT: Gentlemen, on behalf of the Institute of Dental Pedagogics, I will ask Dr. Brophy to respond to the welcome of Dr. Stubblefield.

DR. T. W. BROPHY, of Chicago: It would be impossible for me to express the embarrassment of my position better than to make use of the remarks made by Dr. Stubblefield when he first took the floor. It was intended that another member here should respond to this most cordial welcome, but he has declined, and the president has forced me into this position against my will. Not that I do not value the opportunity to express our appreciation of the most cordial invitation extended to come here, and the cordial welcome upon the part of the gentleman who has just taken his seat, but because I always shrink from responsibilities of this kind.

It is gratifying to feel that this body has grown to be so important in the work of education, and it is a great pleasure to us all to come to the city of Nashville to bask for a while under this delightful Southern sun, to meet the warm reception and cordial greetings of our friends, and to enjoy the Southern hospitality, which is proverbial the world over.

We thank you, Dr. Stubblefield, for this cordial welcome.

PRESIDENT'S ADDRESS.

By Harry P. Carlton, D. D. S., San Francisco, Cal.

It is with great satisfaction and no little pride that the first meeting for organization, held during the World's Columbian Dental Congress, in Chicago, in '93, is recalled. As we look out upon the *results* of that gathering, in this meeting here in Nashville, these few years later, we realize that we have developed and expanded most comfortably for seven years under the title of the "National School of Dental Technics," but this is our first year as the "Institute of Dental Pedagogics," the title adopted at our last meeting to indicate our desire for a broader scope, a larger usefulness and farther reaching results.

That our last meeting was certainly one of great interest and fruitfulness need not be said; our carefully edited transactions testify to that. While deeply impressed with every paper then presented and so ably discussed, the symposium of the fifteen-minute talks on our text-books seems to me to make the most lasting impression, and I would recommend something along similar lines to every succeeding program committee. So much in retrospect; in prospect we are this year to have the banner meeting of our existence as a Society, for the program has been in the hands of a most efficient committee, and we are meeting among the most hospitable and warmest-hearted people in the world. What with program and entertainment in the hands of Henry W. Morgan as Chairman, there will be without question a great "feast of reason and flow of soul."

In glancing over the programs of our last few sessions, I have been impressed particularly by the papers on methods in teaching. Dr. Wright's excellent paper, two sessions ago, on "The Problem of Methods," will be remembered; also the late Dr. H. H. Burchard's on "Teachings of Pathology and Therapeutics," and the able article of Dr. Webster at the *last* meeting, on "Dental Pedagogy," which he considered from the standpoint of psychology, and which evoked a most profitable discussion. Great though the benefits gathered from all these by the attentive teacher, it seems to me that in his opening address of last year, Dr. Hoff struck the true keynote in speaking of the teacher himself, when he asked, "Does it necessarily follow that because a man has made a success in the practice of his profession he is qualified to administer the affairs of an institution to educate professional men, or because he can make a beautiful and artistic filling that he is the man to instruct others in the same art? And are not many of our teaching faculties organized on these standards?" In full accord with this is Dr. Kirk's weighty declaration, "What dentistry needs to-day more than anything else is properly trained and educated teachers."

Accordingly, I owe it to the richness in suggestion of the address of my predecessor that I have a theme for an opening address to-day. I can throw the weight of my opinion in with his by considering, not "What shall we teach our dental students? When shall we teach it? How long shall the course of teaching be?" but "What constitutes the well-equipped teacher of dentistry?"

The subject impressed itself on me at our last session and this arrangement of my thoughts and your discussion thereof, I trust, will prove a means of weighing and measuring of values. To a good many of you veteran teachers this is ancient straw. But for the sake of the younger generation will you kindly turn it over and thrash it once again? Agreeing with our past president once more, I think the floor of this institution the proper place for such discussion.

This properly equipped instructor, like the true poet or musician, surely is not *made*; he must be born. Truly, some of us indeed are "teachers by accident," but most of us are engaged in the work because we like it. With some, again, heredity may play its part. My own father, especially fitted for his life work, spent nearly forty years instructing along *normal* lines, so I think it would be safe to say that *some* of *my* desires at least came not entirely by accident.

It has been said that the best way to educate a man is to set him to work; the way to get him to work is to interest him; the way to interest him is to so vitalize his task that he will love it. These are the foundations upon which the perfect teacher builds. Far more important than the question, What shall we study and how long? is the question, *Who* shall be our teacher? How must Nature have endowed this man, this teacher? *First*, with the gift to arouse within the student-breast an interest so full that its expansion becomes a *love* for his life-chosen profession. With a mental equipment, and possessing a power to *transmit* this mentality; for real teaching is causing another to know. As Dr. C. O. Kimball so beautifully expressed it in a recent paper, "to pass the torch," transmitting to others his fund of learning, observation, experience and skill, talents entrusted to him by no *accident*, but of purpose." So he causes his pupil to *know* as *he knows*, and his intelligence to be awakened and keen, and, having interested and instructed him, to lead the student into making actual application of all practical problems. Briefly summed up, then, our ideal teacher must succeed in causing his pupil to love his work, to know it and to use it. Anything that you or I can do, that will accomplish this thing, is good teaching, and constitutes a good teacher.

The paramount issue with us, then, in the college campaign (and four years is little enough time to cover the ground), is to create an interest, a motive, a purpose—the rest will surely follow. Your new student is first to be imbued with the idea that he comes to the college for the help he can get from the *study*, rather than for the sake of the graduation and the degree, and then every man will be assured that he has made no mistake in commencing the study of dentistry. Be his guide along the paths that traverse the forests of knowledge, gathering general truths, the fundamental points you desire to leave with him. If there be a listlessness to overcome, drop into homely and old expression, that gives the mind a nudge and leaves an impression—that is like turning a corner suddenly and seeing something entirely different from the expected. He will now lend a willing ear, and your instruction will prove effective—for after all it isn't so much what you *teach* him that counts, as what you enable him to think for himself. *Give* him something to think about—something to occupy his attention while you are impressing your vital truths. You may have heard the story of the old blacksmith, who tried time and again to shoe a most unruly mule (a mule unusually endowed), and he generally was kicked out of his shop before finishing the work. The smithy studied long upon some plan for success. Finally one day he tied a little piece of string around Mr. Mule's right ear—not too tight, he said, but tight enough to give him something to think about; and he gained his point.

Oftentimes there will be no power in the book or even in the subject to overcome the apathy; then the power of the man, his personality, should score. Do not mistake me and think I believe that *individuality* should come to the front. The curb must be kept on *that*, lest it be overdone. We are apt to become *too* enthusiastic, feeling our success, on noting the impression being made; to enjoy it too far and become vain, and indulge in it for our own pleasure.

I once heard a dental teacher say, "I like to lecture to those Freshmen immensely; they are so new, they drink in every word you say, and anything goes; but I am afraid of the Seniors, they know it all." This type of teacher is not in earnest, his well is shallow, and, as Dr. Barrett so aptly said last year, "his pump will soon suck air and he will have to quiz." The earnestness that aims at great success never fails; once let it enter and everything mean and unworthy is excluded; all follies give way before it; all indolence, apathy, antagonism, give place to earnest endeavor.

The instructor who has earnestness in himself, not a false and simulated thing, like a flitting phosphorescent glow of marsh gas, but the *real thing*, that gives a steady flame with warmth, as well as light, communicates his light and heat to those so fortunate as to sit before him. The eminently successful man is an *enthusiast*, whatever his occupation, especially the man who aims to interest other men and prompt them to make their best efforts.

Men follow a leader who inspires confidence by believing in himself, and the "world stands aside to let *him* pass who knows whither he is going." True, this self-confidence may rest on small and uncertain attainments, and yet it is a "motive force," and as such produces motion, and motion is necessary if we are to "get there." No cold and hesitating instructor may hope to inspire that all-absorbing passion for knowledge that sometimes dominates men's minds and makes them devote time and talents and life itself to the pursuit of science or perfection of art. The American teacher is supposed to know something about *everything*, and as much as he can learn about *something*. There are many who consider such knowledge as a complete equipment for the work he has to do, but it is *not*. If he has not *enthusiasm* he will be as dry as the dust in his own lecture room. Not infrequently the young man who works out to-day what he must teach to-morrow is far more successful than the veteran whose familiarity with the subject makes him forget the difficulties he had to surmount, the problems *he* has mastered. I would not convey the impression that I favor superficial attainments, for I do not; but earnestness with even *moderate* attainment is more effective than a perfunctory performance by the most *erudite*. Enthusiasm is contagious; it gives a ring to the voice, a flash to the eye, a flush to the cheek, an incisiveness to the speech. If we know what we are talking about, and know it well, and talk about it as if it were of vital importance, we may fling all the theories of the pedagogues to the four winds, for we will create a desire for the fullness of knowledge that will not rest satisfied with anything else. To the student thus vitally interested, the acquirement of knowledge will become pleasureable rather than painful; its presentation to his unfolding mind creates a healthy appetite to which you and I must cater, not with indigestible material, but with facts ready for his digestion and assimilation.

We have heard a great deal said of methods and methods. We *all* believe in method, but *freedom* of method with originality. An eminent educator recently said, "*Text-books* really hold the great majority of our teachers down to a well-defined routine." To all practical purposes we dental instructors are doing the same things, teaching the same material in very much the same way. But teaching and *depending* upon *another's* methods is very much like "wearing the other fellow's coat." There must be the *man* along with the method.

They tell a story of a professor in some Eastern college who was a splendid instructor in mathematics. In a foolish moment he was persuaded to write a text-book on his subject. He wrote exhaustively, but it was a complete failure, because he could not put *himself* between the covers of the book. Good text-books, that have stood the strain of criticism, text-books constructed out of the experience of better teachers, are a guide to us in the arrangement and logical sequence of the main division of our subject. So far, at least, should they be at our hand to keep us in line. There is absolutely no way, to my notion, that a teacher can keep *en rapport* with his class except through the medium of a good text-book. But this narrowing a class of young people down to *a* text-book—this shackling of their minds to it—is very bad. Beware of "domination of authority"; the teacher by the text-book author, and the class by *his* authority. Some of us are apt to indulge in this method of instruction, thus limiting the expansion of the student's mind. This ironclad system of pedagogy, as now served up in the majority of our public schools, doesn't appeal to me. Your child and mine, and everybody else's, are stirred up together, and made into a paste and pressed into shape, like so many bricks—molded just so, exactly alike. They do their examples, write their Spencerian copy, precisely alike. It is not until the pupil gets away from this sort of sore-back, method-ridden system, so much in vogue to-day, into the broader atmosphere, let us say, of the University, that he really commences to think for himself. On the contrary (and equally unsafe), there is such a thing as cutting away all restraint; knocking out all the blocks, and floating away on a current of our own choosing. We, then, in our line of instruction must establish the practice of "appealing to their *reason* until they have gained the right to private judgment."

Methods have their place, but "the fire will not burn with all the laws of science or combustion at your command, if you lack the material with which to lay the fire ready to burn."

Some of you may remember the inspiration there was in the old-time winter school, conducted by some young college student for the purpose of paying his own way. *He* had no theories—very little of practice or of other men's methods; his text-books were few and ill-advised. But what of it? He had what was better than courses in pedagogics, better than libraries, better than text-books, however good—he had a tremendous earnestness in himself, that brooked no opposition, and it begat a like earnestness in the boys who trudged through the snow to sit and learn. I have heard men refer to the "superficial training" that boys received in those days, but when I think of the thousands of our greatest men who had nothing better than the winter school, and oftentimes little of that, I am persuaded that all the value does not lie in pedagogical theories and practice, text-books and fads. Contrast, then, the old with the new, and let not the new cast out *all* the old; for all good things are ours; all good methods and means and the thoughts that have come out of honest minds, are ours to adopt, and we should build them in. "We must know the paths our predecessors have trodden if we would tread them farther."

The mechanical routine teacher is *satisfied* with his work and himself. His whole business resolves itself into that of a pump—simply to be pumped full from some reservoir, that he may fill all the little pitchers held up to his nose. In contrast, a perennial spring, constantly bubbling forth, a center of supply—the one a task-master, the other an inspiration.

"No part of a man's education is of very much value to him unless it is in *some way* concerned with his future growth," says Dr. David Starr Jordan, of Stanford University, and this is specially true in dental education. There is a strong tendency among students to devote their entire energies to the practical branches, seemingly ignoring anything and all that would promote the spirit of research; the result—a "bread and butter" course of study. Whether the attitude of mind that demands an immediate result and in the same breath wants to know what there is in it, is favorable to the advance of knowledge, or not, is a question; yet this is the attitude of the American mind to-day. When we have less of the "White Man's Burden" to bear, we will doubtless accomplish much more in deep research.

This desire to *go to work,* this indisposition to undertake deep study, has filled the country with "Cramery Schools"—institutions that offer to equip the student for an active professional career in a few months. They furnish facts without reason, solutions without proof, and turn them out upon the public what *they* call "practical men," to make blunders, to do harm, sometimes irreparable, and bring technical education into contempt among those who are not able to detect a fool masquerading in the garments of a student The one sure way to fight such institutions successfully is, having equipped the faculty with men of quality, to make instruction deep and as far as possible exhaustive.

Given our student filled with enthusiasm for his work, and having gained a mastery of its general truths (the final aim of all instruction), the teacher's task remains to enable him to turn all this to practical use, and it ought to be an easy and natural sequence. Herein lies the value of personal contact, those hand touches which make you friend and associate, instead of professor. We may talk forever from the platform, but it is the personal work that does the *real* good. Here we get the impress of knowledge upon knowledge, and are down among them, inspiring and invigorating.

Here is a new vision of what education means—not the pouring in of knowledge by the quart—opening the student to see how much has been poured in; but *seeing* him think, talk and *express his thoughts* by putting what knowledge he has absorbed to practical use. I will speak of methods only to say that it seems to me that we should teach *principles* to the *lower classes,* and then get in touch with the Seniors, aiding those who are struggling, perhaps failing, in a way perhaps, no demonstrator can do. With very large classes, this is well nigh impossible, and the true lover of teaching deplores the unwieldy college classes, where large numbers prevent personal contact. But *that* personal contact exercises the greatest power when, in addition to these qualifications of enthusiasm, mental equipment and practical ability, there is added *moral fiber*. If there be behind the teacher the manly man, the individual of the purest moral fiber, you have what must ultimately be the greatest and most lasting success as an instructor.

DISCUSSION.

DR. H. B. TILESTON, of Louisville, Ky.: In being selected to take part in the discussion of this excellent paper of the president, it seems to me that either my age has been overestimated, in grouping me with such patriarchs as Dr. Taft and Dr. Barrett and Dr. Weise, or I may accept it as a compliment to my experience and ability as a teacher, which, in that case, I know has been overestimated. Or, perhaps, we were all chosen because it might have been surmised by the Executive Committee that a president's address would not likely be of such a character as to call for very active and up-to-date discussion. If that were the case, then an unfortunate mistake has been made, for this address of Dr. Carlton's deals with the most live and vital question that could possibly come before this Institute of Dental Pedagogics—*the question of the teacher himself.*

It is a fact—deplorable indeed, but nevertheless a fact—that there are many men now engaged in teaching in our dental schools who are utterly unfitted to the task which they have undertaken. But it must be remembered that we have no normal school where teachers may be trained in the line of thought and action necessary to take positions as professors in our colleges. It is true we have this Institute of Dental Pedagogics, but it is not adequate to the demands as a teacher of teachers, to teach. We meet once a year, and we have a session of two or three days, but we cannot expect to make teachers in that length of time. Nevertheless, this institution is an excellent aid to instructors, in the fact that we get inspiration and new ideas, and if we go home and put them into effect, there is no question but what this organization is of great value. And yet it is not equal to the task of making teachers. For these reasons it has been necessary, in the newer schools, especially, and in fact in the older schools as well, to put men into positions as teachers who have not had the special training necessary to make them successful. Occasionally these selections have been wise, and men have developed rapidly into positions of prominence. They are the men who probably are "born teachers," as Dr. Carlton expresses it.

Now there are some men who are born great, others acquire greatness, and still others have greatness thrust upon them. With those who are born teachers there is no difficulty; they take hold of the work and succeed in impressing their ideas upon the minds of the students without any trouble at all. Then there are those who have acquired the art of teaching—and I do not know but what they make the most valuable teachers, because they have gone over the rough road, they have hoed the ground over themselves, and they know just what it is; it has impressed itself upon them, and if they only have the ability after having acquired that knowledge, of transmitting it to others, then they make very valuable instructors. Then we have that class upon which the position of teacher has been thrust—and I believe that represents the largest number in the professional schools to-day. They are men who may have been selected because they happened to have been associated with those who originated the idea of the college, or maybe personal friends of the faculty, or some who have assumed positions of prominence as writers, or they have been selected sometimes to chairs in the line of their daily office practice, or, according to the necessity which existed, to fill anything which happened to be left unfilled. Hence our teachers are not always best fitted for their positions, but it is a matter that cannot be helped. The best teacher of teachers is experience, and it will take many years to equip all of our schools with men of the caliber and grade that we desire to have.

Those upon whom this distinction has been thrust are the ones the essayist refers to as "teachers by accident"—a great many of us, I think, are "teachers by accident."

The object of a lecture, Thomas Huxley says, is: First, to awaken the attention, and arouse the enthusiasm of the student, and this can probably best be done by the personal influence of the lecturer, who understands what he is talking about, and for that reason commands the respect of the student; and in the second place, the lecture serves to direct or guide the attention of the student to the salient points of the subject, and at the same time compelling him to consider the whole subject, without allowing him to follow what personal taste he might have to take up some certain line of thought because it suits his fancy. But, after all, the lecture is but an accessory to that great instrument of scientific instruction, Demonstration.

The essayist has said if you want to educate a man put him to work; and if we attempt to teach a scientific subject by lectures alone, we will fail, because the limitation of language is such that we cannot possibly impress upon the mind of the student adequately, by means of words, a complicated operation like the preparation of a cavity and the filling of that cavity, from the platform. You cannot do it. In teaching so intricate a subject as dentistry there must be method regulated by system, and the system should be of such a character as to keep the lecturer and the demonstrator exactly in the same line; they should be in perfect harmony, and there is no better way, perhaps, of acquiring that, than to have a school among the demonstrators. That has been put into active use—has been the custom, I think, in the Northwestern School, under Dr. Black, and it has been put into use in our school to great advantage; meeting the demonstrators as a class, keeping them in strict accord with the lecturer, so that the demonstration will follow in perfect harmony; and there should be given nothing to the student in one department which is contradicated in another.

There is a difference between learning and knowledge. A student may take a text-book, and he can memorize that text-book if he has a retentive memory, from beginning to end, and he has learned it, and he may have such a retentive mind that he can listen to a lecture and almost repeat it afterward; he has learned it, and yet he has no knowledge of the subject.

The only way, in teaching scientific subjects, in my opinion, to give both the learning and the knowledge, is to demonstrate afterward what has been presented from the platform—either by the professor himself, if he has the time, or by the demonstrator, who, I suggested a moment ago, has been trained by the lecturer himself so as to be in perfect harmony with him and his teaching in the demonstration. A good plan is to divide the class into small sections of twelve or fifteen, and the professor can meet those sections in a room set aside for the purpose, and can demonstrate to them what he has been telling them from the platform. The difficulty is, that in large unwieldy classes, which are complained of by the essayist, and very properly complained of, it takes so long to get around to the whole class, and to demonstrate all the operations described from the platform as to make it practically impossible. It is possible only to take up the more important ones, those upon which the whole subject may hinge; demonstrate the principles, and arrange that other things will come up in the course of the demonstration by the other demonstrators, so as to complete the subject thoroughly and fully.

Now the essayist spoke, finally, of a point of vast importance, though he did not lay a great deal of stress upon it—that is, with reference to the moral fiber of the teacher. That struck me, when I read the paper, as a thought that would bear dwelling upon for a few moments. We, as teachers, come into contact with young men who are at an age, frequently, when their character is being moulded, and if we are of such standing as teachers, in their eyes at least, as to command their respect, they will not only want to do as we do in filling a tooth or treating an abscess or in making a crown, but they are very apt to follow our example as to our morality. And it seems to me that it is incumbent upon us as teachers who come in contact with young men at this moulding period of their lives to be examples worthy of emulation. I desire to commend that part of the president's address particularly.

DR. L. S. TENNEY, of Chicago: I am very glad to be given an opportunity of commending this brilliant effort of our president. It was certainly a most interesting paper, and one that bore every evidence of careful thought and careful study. We all realize, I am sure, that he has dealt with subjects of vital importance, and that upon our ability to secure teachers well equipped, well qualified and well endowed for their work will depend, very largely, our growth and advancement in the future. It was Oliver Wendell Holmes who said: "It is not so much where we stand as in what direction are we moving." The Institute of Dental Pedagogics has always taken an advanced stand in furthering the cause of dental education and dental teaching; that, in fact, is the object for which it was created, and there is no doubt that our work is on a vastly higher plane to-day because of the efforts of this body.

I was particularly impressed with the forceful manner in which the essayist drove home the point that he wished to make. Taking as his subject the qualification of the dental teacher, he has built up a most careful and convincing argument. He has endeavored to impress upon our minds the necessity for correct teaching and correct teaching methods. What is it that constitutes the ideal practitioner of to-day? Is it the man who goes to a college, learns just enough to get his diploma, and then goes out in the world and isolates himself from his fellow-practitioners, satisfied with his present attainments; or is it the man who regards his college education as merely a foundation upon which he must build. Certainly there can be but one answer to that question, and if we are to produce men who are of this type and are to become true professional, progressive men, then we must imbue them with the proper idea and the proper spirit while they are still within the college walls.

In speaking of the subject of the enthusiastic teacher, I recall the words of Dr. C. N. Johnson, who, in discussing this very subject, said: "In order to secure the best results in the class room the sparks must fly from teacher to student." And so it is; if we can put into our work the proper zeal and earnestness and enthusiasm we shall find that that same spirit will become contagious and will be reflected in our students. In that way, and that way only, can we get that intimate contact with mind to mind that is so essentially necessary in imparting knowledge in the class room.

When, again, the essayist said it is not so much what we teach him as what we enable him to think for himself, he touched upon a very important and a very broad subject. Some one has said that the object of all true education is to create a capacity for learning, by which is meant, no doubt, that it is not so much what we succeed in pounding into a student's head by hard labor and persevering effort as to what extent can we train and develop, and make his mind receptive; to what extent can we create in him the power of original thought and original work. Now whether this is a question to which we can devote ourselves is certainly open for discussion. It would appear not. It would appear that within the time that we now have at our disposal, it is all we can do to ground a student in the fundamental branches and to teach him the mechanical requirements of his work, without attempting the development of his intellectual faculties.

It seems to me, then, that the only solution of this particular problem is to demand a broader education before entering college. Now, gentlemen, I know this is a subject that cannot properly come before this body, because it is not in any sense a legislative body, but we can at least give our moral support, and we can let it go forth that the Institute of Dental Pedagogics stands for a higher education, and a more extended course of study, as the essayist himself has indicated.

Whenever I look at a great body of students, many of whom are men who have not for years engaged in intellectual work, I wonder how, in a short period of twenty-one months we succeed in teaching them half as much as we do. It seems to me that that alone is one of the most eloquent tributes to the correctness of our teaching methods. I think, however, that we have about reached the limit of our attainments, and while we may hope, or may expect to improve our work, in details, here and there, yet we can never expect to accomplish very much more, until we have more time to devote to our work.

Gentlemen, I think we have every reason to congratulate ourselves on the excellent paper that our president has presented to us.

Dr. A. E. Webster, of Toronto, Canada: It was only about fifteen or twenty minutes ago that I had this paper to read over, so I may not be able to say anything in a very connected manner, of course, but I have put down a few points, which have not been touched upon.

I think this society is to be congratulated on having such a paper read before it. I never read a paper in my life that I desired so long a time to study and carefully think about what it contains. It contains the food for a great deal of thought and a great deal of work.

I might say just a few words in connection with the amount of knowledge that the teacher should have. The first thing that he ought to have is a knowledge of himself. He must have a thorough knowledge of the means by which he gains knowledge himself. Let him study that. For instance, let him take a thought and say, "how did I come to this conclusion," and think of the method in his own mind, how he obtained certain information. For instance, you see something and that suggests something else, or maybe you get a suggestion in your mind, and you do not know how it has come. It is very good study for yourself, just for a moment to think how that suggestion came into your mind at that time. That will give you a clue into the manner in which our students get their information.

Then we must know the student. And by knowing ourselves well we will shortly know the student; and when we learn the bent of his mind we know in what direction he is thinking, and by what means he attains knowledge.

The last speaker mentioned something about the training of the mental faculties, saying that it was about all we had time for, I think, was to give the mechanics of dentistry and to give a general information. I think that is probably not quite correct, in some respects. For instance, we can teach the subjects that we are intended to teach, according to the natural means of gaining knowledge, and thereby train the mind. For example, when we expect to teach anatomy, by giving two years' lectures in the subject, and then start the student to do dissecting; is that according to the bent of that man's mind? I say not. This subject was brought up last year, and not discussed. I want to bring it up again. Take, for example, physiology, according to the method we have ordinarily in our schools—I mean professional schools, it is directly opposite to the way it is taught in our public schools and high schools—but remember these men have been taught teaching for years. How do they start physiology? Do they start from the cell and build the whole subject up from that, and go on to the tissues and the frame and make the whole man, or do they start the other way? They take the whole man and run him down to the cell.

I want you to grasp the one point; that we see and learn generals first and particulars after. That is the ground principle upon which our educators are working to-day. Do we teach our physiology that way, our anatomy that way? Do we give demonstrations first and theory last, or theory first and demonstrations last. I just want to bring that out for discussion again.

You take, for example—and we can think probably more practically of some definite thing—in dental technic, we take a whole set of teeth first, and we study the whole set, and then an individual tooth; then we take an individual tooth, and then the surfaces of that tooth—one surface of that tooth, instead of the other way, beginning with one surface of the tooth and so on, back until the whole tooth is learned and later the whole set. I know a man who lectures on anatomy; in fact, the first thing he does, he starts up with a bone in the first lecture. Who knows where that bone came from, and worse he lectures on one surface of that bone. There is no connection between what the pupil knew before and what is being presented. I do not wish to follow that subject any further—only just to draw it out for thought.

Now the question of lectures, whether we should demonstrate or lecture, and so on, amounts to but little in my mind. I think a great deal depends upon the teacher. A man who can teach well by lectures I think probably would do better to follow that rather than go into a business that he is not fitted for.

To the man who quizzes well, it would probably be foolish for him to try to teach without that aid. As a lecturer has said, have every means possible to give instruction. Make a fine distinction between what is knowledge and what is mere information—that must be made by the teacher.

The essayist drew attention to one thing that is very important, and that is, not to stifle the individuality of the student. Let your student be a man from the time he comes in until he leaves, and just as much an individual, and not a class. How much simpler it is in the class room to have every man working, every man interested, every man putting in his say. Compare that with the method of the man who is highly respected and stands off and gives a cut-and-dried lecture. The student does not have anything to do with it and is consequently not interested.

In lecturing, another point that I wish to draw out is, to be guided by the circumstances at the time of lecturing. It will not do to prepare a lecture and follow it right up in detail. For instance, you find frequently that you come to a point where the student knows all that you are talking about, which would necessitate a change of plan—how shall we know? That seems to be difficult for some men, quite simple for others. How do we know whether the students are interested or not? The sparks must fly, as the last gentleman said, and you know, by that means. When you don't know, stop and quiz and find out. You can find out readily by the eye on you—and unless you get the eye on you, you might just as well sit down. I prefer, myself, to lecture this way, not to fill out the whole hour and twenty minutes or hour and a quarter. When I find that I have finished, or we are all through, giving close attention—we are doing this thing together, and the boys are through, to stop—there is something wrong. It is not something wrong in the student, either, it is something wrong in Number One when the students do not listen. Sometimes I lecture an hour and a quarter, sometimes ten minutes, and sometimes even less than that; and if you find the lecture does not *go*, you might just as well quit and stand out before your class and say, "Gentlemen, there is something wrong, we will quit and try this in the next lecture," and think about it, doing it in a different way next time. I have frequently said to the class, "This lecture is a failure, let me try it again." It is all right; the student doesn't mind it a bit. Try it. Next time you will do better.

I wish to congratulate the president for his excellent address.

Dr. W. C. Barrett, of New York: After making all the necessary preparations, at the last moment I find myself unable to attend the Nashville meeting, and in accordance with the request of the committee I write out and send that which I was invited to present in person. I am deeply impressed with the thoughtfulness of the address of the president, which I have been permitted to read. If all were imbued with the spirit exhibited in that paper it would be the better for dentistry. It is broad and catholic in its tone, and is redolent of a devotion to duty and a self-abnegation that is very refreshing in this mercantile age. I cannot hope to strengthen it by any words of my own. May I not be permitted to supplement it by adding another phase, and may I not be forgiven if I speak plainly and even bluntly, always remembering that it is honestly and sincerely and in the spirit of love for my profession and my professional brethren.

Last year this association appeared to have come to the parting of the ways, and a departure from the traditions of the past was made. The very name of the society was changed, and to some of us old fogies it was for the worse. The new cognomen may to those who are attracted by mere sound be more pretentious, but if a more priggish, presuming title was sought, the best of all those offered was not selected. A still better one might have been something like this—The World's Solidarity of the Pedantic Pedagogues of the Universe. That name would have given plenty of room for future growth, and certainly no fear of being considered ridiculous would have restrained us. This society was originally formed to foster the teaching of technics in our dental schools. That branch of our professional education had been sadly neglected, or had never been developed, and it was most distinctly a step in advance when it was sought to make more prominent in the curriculum of our colleges the training in manipulative skill upon which our practice so broadly rests. To perfect the coming dentist the education of his hand must accompany that of his head. His mechanical intelligence must keep pace with his mental growth. The brain which can conceive is useless without the fingers that can execute. So far as dental practice goes, the student might as well lack his head as to be without his hand. If I had a tooth to fill I think I should prefer the man who knew practical dentistry and nothing else, to him who knew everything except just how to do that particular thing.

Americans have always been a practical, ingenious people, who usually found the shortest route to the end sought. The fact of their segregation territorially from other nations, the necessity for subduing a wild country and out of the primeval forest and prairie to elaborate a civilization of our own, has made us in some respects different from the nations who have through many generations inherited their training and habits and methods from their ancestors. The very conditions under which our national character has been formed have proved an apt soil in which to grow that peculiar manual dexterity demanded in dental practice, and with the dawning profession there sprang up a class of men who soon became the most skillful operators of the world. But they lacked in the mental discipline which is obtained chiefly from an extended scholastic course. Dental professional schools were first established in America, and the building up of a proper curriculum of study was a matter of experiment, for there were no old traditions to serve as landmarks. What was chiefly lacking at the outset was a rigid system of school training in natural philosophy and abstract principles, and that the National Association of Dental Faculties is to-day gradually developing.

But hand in hand with this work must go the physical education and the manual and digital training by which alone can artistic dexterity be acquired. The expert pianist must begin this physical discipline at a very early age if he hopes ever to acquire any great proficiency. The music teacher commences to spread the hand and to give mobility to the fingers and independence of action and distinct individuality to the thumb as soon as the child can sit upon the stool. Even with the highest natural mechanical intelligence years of stern drill of the muscles are absolutely essential. It is not sufficient that the average American has good mechanical sense and aptitude in acquiring skill in handicrafture. That innate capacity must be properly directed, and that latent talent developed through systematic manual training. One of the most hopeless students who was ever my pupil in college was one who had graduated abroad in almost everything. From a German gymnasium he had gone to the university and completed the course of study there, graduating with his M. A. He had then taken the full university medical course, graduating again with his M. D. After this he had spent some years in post-graduate study, including lectures in dentistry. At twenty-seven years of age he came to America with one of the best-stored and trained minds conceivable, but with the most ignorant hand ever attached to a human arm. He could form no mechanical concept of a piece of work, and could he have done so he had no hand educated to perform it. It took two years to teach him how properly to grasp and manipulate an excavator.

There was, then, a few years ago, a great field for the exercise of the energies of the Technic Association. There was a distinct work for it to do—a branch of teaching otherwise neglected. During the very few years of its existence it has accomplished great things in systematizing the instruction of the hand. It has been steadily making progress, and it has bid fair to give to American educational methods a supremacy that would be undisputed in the very field in which our profession has won its greatest triumphs. But last year thoughtful men observed with pain a tendency to forsake the useful for that which was thought to be more ornamental—gradually to abandon a field in which those engaged in the work were acknowledged experts for one seemingly more pretentious, but of which they were in almost dense ignorance. It appeared like an outcropping of that spirit, born of a lack of knowledge of the fitness of things, which prompts the trustees of some young and beautiful and rapidly growing country town to change the pretty, appropriate names of its streets to such monstrosities as "National Avenue" or "Hawthorne Place," when not a resident would be able to recognize a hawthorn if he saw it; or to ape larger cities by calling them "Broadway" or "Pall Mall," forgetting that in so doing the width and character of the street does not expand with the name, and that the assumption of great city airs only makes the inhabitants ridiculous.

The definition of technic, or technique, is, The doctrine of the arts in general; the details of the mechanical performance in any art. What more expressive name for our society could have been chosen than that which so exactly describes its function? Pedagogics means pertaining to the science and art of teaching—the methods of the schoolmaster—the pedagogue; the latter term commonly being used disparagingly. What could be more absurd than for this association of professional men to assume the pedagogue, or to pretend to be expert in the methods of the schools? That is peculiarly the branch in which they are least skilled. We are *not* pedagogues. Teaching is with us only incidental. Our livelihood is obtained from the practice of our profession. There is not a man among us whose life is devoted to the calling of the pedagogue, nor one who gives his whole time to instruction, unless it is in a very subordinate position, and even such teachers necessarily teach technics and have nothing whatever to do with pedagogy as a science. It must have been ignorance of the real situation and of the significance of words that prompted the movement of last year, or it was the result of lack of thought and consideration. That certainly is how it appears to the old fogy.

I desire to enter my earnest protest against any such shifting of policy and such vain assumption as the change made last year seems to indicate. I hope that we may stick to the old paths of honor and return to the title under which this association won its triumphs in the past years, and that its scope will be confined to the field which it is so competent to cultivate, and that there will be no attempt made to invade the realms of pedagogy or to pose as members of a calling which certainly is no more honorable than that which is legitimately our own. Let our greatest pride be that we are dentists, and dental teachers if you will, and not schoolmasters.

Dr. G. E. Hunt: The chair can hardly conceive of any set of remarks that would have been more conducive to the writing of a paper such as the president wrote than those that have just been read by our secretary. For the dean of an institution and a member of this association to say that teaching is merely incidental in his career, or that he does not see any necessity for us being trained teachers—which is practically what he does say—is in the nature of a surprise, surely, to this body. Up to this point, it seemed to me that the discussion of the question had been pretty completely concluded, but with this last communication on tap, I will announce that the discussion of the paper is still open, and we will be glad to hear from any or all of you.

Dr. Thomas E. Weeks: Mr. President, there is one point touched upon in the paper which naturally appeals to us, and I would simply emphasize what was said about holding school for the demonstrators; that is, the necessity of all the teachers getting together and comparing methods; the younger men will naturally gain from those of more experience, and their energy will be transmitted to the older men, who, it was hinted, might become a little careless sometimes. We have found that the acting together of the whole body, including the teachers of the primary branches in medicine, has been of wonderful benefit to all of us. Then the different departments—that is, the chair of operative dentistry, for instance, gathers his teachers about him, and they discuss what is being taught, and how to teach it, in operative dentistry; the lack of normal schools in which teachers may be trained can in a measure be compensated for by this method of having frequent meetings of all the teachers, and between times meetings of the teachers interested in special subjects.

Dr. J. H. Kennerly, of St. Louis: There seems to be one point that particularly attracted my attention in the paper, that of personal contact with the student. Until the present term in my capacity as teacher of prosthetic dentistry, I have had the privilege of teaching prosthetic technic also. I have found that by personal contact with the student from the time of his entrance into the school, it is not very long until, as one gentleman remarked, the sparks began to fly. By personal contact with each and every man you can find out where he is principally lacking, where he failed to grasp what you particularly desired to teach him. The present term I do not teach prosthetic technique. There are a good many of you who know that I have changed from one school to another, where I unfortunately fell among a class of students, not one of whom I knew, and consequently my work as a teacher this term has been one of unusual hardship on account of the lack of that personal contact and acquaintance; and, gentlemen, I want to say to you, that there is no point mentioned in the paper that is of such great help to the student as well as the teacher. Get in close contact with your students; the earlier this contact begins in the history of the student the more or the better will be the results accomplished.

Dr. Brown, of Milwaukee: I would like to drop a little oil upon the discussion, if I can, in relation to thoughts suggested by Dr. Barrett's discussion of the paper. It seems to me that he brings this question before us in something of a wrong light. What he says is true enough, beyond any question, but to my mind it is because of all that the Technic Association, considered in its limited sense, has accomplished, that we are now ready to do something more.

We realize through having accomplished so much by the systematic development of one portion of our work, that now it has become necessary for us to systematize and become skilled in other branches of the work. Therefore, it seems to me, regardless of the name, that the change in the purposes of this association, or a broadening and continuation of its purposes, if you may so call it, was decidedly opportune—was by all means the thing to be done, and I think the discussions of the paper, as well as the president's address itself, have certainly demonstrated to everybody the fact that we are now ready to take a great step forward.

Dr. T. W. Brophy, of Chicago: I listened with a great deal of interest to the reading of the able paper by the president. I do not know that I can add a word to what has been said in complimenting him upon the discussion of the subject, except to say, in illustration of one feature of the paper, that a year ago now, after the meeting of this association at Philadelphia, I took a trip down South with my friend whose written discussion has been presented, and we visited one of those beautiful old southern homes in Columbia, S. C., and found in that home a large family. There were ten children in the house, and as we sat at the table these children, the smaller one next to the mother, and so on, ranging up next to the father, presented a most beautiful sight; and while I was down there I never heard a word said in that family about it being large and unwieldy. That is the feature of the paper that I want to discuss. What does the gentleman mean by saying that the class is large and unwieldy? I never heard any such remark made by the teacher from a school where they have large classes. And personal contact is another question. What is meant by personal contact? Is it meant that the teacher—the head of the department—is to have personal contact with each student of his class, or does it mean that his so-called unwieldy class cannot by careful management have its work so systematized that each student will receive personal contact from his teacher. Does it mean that one man is to teach all the class, or is it intended to have the class divided into small classes with an able teacher at the head of each small class, thus giving personal contact with the students? A large family is trained and educated so that each member may become just as useful a member of society, and far more so, than you would get in a family where there is but one child. Now I did not like that phase of the paper and discussion, because a large institution, a large government or a large corporation may be conducted with just as much care, and each individual acting within the domain of the government or the corporation or the association, may be just as carefully managed as though there are only a few. I think that is the weakest part of the discussion that has been entered into here this afternoon.

There is one feature of the discussion I particularly enjoyed, and that is the remarks of Dr. Kennerly; and I see more clearly than ever before the wisdom of cutting the great canal between the City of Chicago and St. Louis, for I have learned for the first time that it has caused the sparks to begin to fly in St. Louis.

Dr. G. V. Black, of Chicago: I was unfortunately out a few moments and failed to hear the reading of the address. For that reason I did not feel like entering into its discussion. Of course, I got some idea of what it consisted from hearing the discussion. The paper presented must have been an able one, to call out such a discussion and I have been very much pleased. I might say a word as to the change of name. I should certainly differ materially from the ideas presented in the discussion by the gentleman from New York, for the reason that I have seen in the tendencies of this association a desire to enlarge the range of subjects taken up. The fact is, that this is the only association of *dental teachers* in the United States in which the subject of *teaching* is discussed. The Faculties' Association, as we all know, is occupied with legislative work, and the subject of teaching is not entered upon at all in that association, and therefore this is the only association for the discussion of such subjects, and the desire has been very generally expressed that this association take up the whole range of dental teaching.

Now, gentlemen, whatever may be our standing, individually, in the practice of dentistry, if we enter a school room and undertake to teach, we either become teachers or failures, and if we are to become teachers we must study this subject of teaching—pedagogics, if you please. It is as necessary that we study the subject of teaching as it is that we study the technical procedures in our operating for our patients. Or, as we study the conformation of the tooth when operating for our patients, so we must study teaching when preparing to go before our students. We are endeavoring to instruct, therefore we are teachers; we are a body of teachers, and the study of methods of teaching is our business here. We study particularly the methods of teaching in dental schools, but in studying the method of teaching in dental schools we must study the principles of teaching in general.

PRESIDENT H. P. CARLTON: Fellow members, I want to thank you for the kind reception you have given my effort. I am more than pleased, especially after hearing the remarks of Dr. Barrett, because he has given his attention principally to the name of our association instead of to the address. I must confess that it was with some fear and trembling that I read his name among those listed for the discussion of my paper, because I expected that he would handle me severely. My efforts were intended to be directed purely and solely toward the *ideal* in teaching. It was not a comparison or a criticism of any class of teachers. I wished simply to draw as far as I was able a *picture* of the ideal teacher, as I had him in mind. I wish to thank you very much, also, for the discussion it has brought out. If it has done any of you as much good as it has me I shall feel satisfied.

THE USE OF FLEXIBLE RUBBER DUMMIES IN ORTHODONTIA AND OTHER TECHNIC TEACHING.

By J. Q. Byram, D. D. S., Indianapolis, Indiana.

That method of teaching which enables the teacher to intelligently explain his subject, and the student to comprehend clearly that which is being taught may be considered the best. Methods of teaching, like methods of operative procedure, give different results with different individuals; likewise one teacher's methods, be they ever so good, may be of little service to another. In this progressive age, those of us who care to keep abreast with the times must continually seek such methods as will yield the highest results.

The use of flexible rubber dummies in technic teaching is in its infancy, still the field of usefulness is already wide. I am a strong advocate of this method of teaching both operative and prosthetic technic, for with properly constructed dummies all operations can be taught in a skillful and scientific manner, and the principles of some operations can be taught better with dummies than in the mouth. The use of these dummies in technic teaching opens a field for great opportunities. I have been experimenting along different lines for the past year, and find the work both pleasant and profitable. I wish to thank Dr. Webster and others for valuable suggestions on the use of flexible rubber in this line of teaching.

Orthodontia technic is a hard subject to teach, because the correction of irregularities is based on varied mechanical laws and scientific principles. Unless the student is familiar with these laws and principles, or has them demonstrated to him in a practical manner, he cannot have a full conception of what is being taught, or what he is trying to do. If a student construct an appliance on a plaster cast, he is taught that this appliance will produce certain results provided the proper mechanical laws are applied, but in many cases the rigid cast does not enable him to see the particular application to the case in hand. So what we need is some method by which we can show objectively just how these laws governing force are applied. Some may say let this be demonstrated in the mouth. Theoretically, this is very good, but, like clinics for other departments of technic teaching, there is such a dissimilarity in the cases presented that it is difficult to secure material for the case in hand at the proper time. By constructing a number of flexible rubber dummies, representing the different classes of irregularities, we may have a stock of models for demonstration. When the student constructs an appliance for a particular class of irregularities, if he has a dummy representing this class before him, with an appliance adjusted, then he can see the force applied, and at the same time he has a pattern for constructing an appliance.

Dr. Case did us a valuable service last year when he presented a syllabus for teaching orthodontia technic. I agree with him that the first training a student should have is to construct some of his tools, his stock material and appliances in general. But I believe this should be the secondary object of his work. The primary object should be to work out certain mechanical laws governing the application of force, for the appliance is only the machine, by which the application of force is accomplished.

I fear there is a tendency to make a machine of the student by looking too much to the mechanical side of our work, without involving principles. This will be the result if too much stress is laid on the construction of appliances without demonstrating their proper application. Any student can be taught to do most operations in a machine-like way, but, after the operation is completed, he has very little knowledge of it other than what he gained by merely going through the different steps. It may be asked if he can go through the different steps of the operations—has he not obtained the desired results? While he may have obtained results, he has not obtained the highest possible results.

It is not my object to go into the technic of constructing appliances or the methods of attaching them, but to present my method of demonstrating the application of force by the use of flexible rubber dummies. First, I have dummies with normal arrangement. You will see how the teeth can be separated by the use of elastics, floss, wooden wedges or the mechanical separator. Second, I have a lingual displacement of the superior lateral. The appliance used makes a pressure toward the labial on the lateral, at the same time forcing the central and cuspid apart. Third, I have a labial displacement of the cuspid, and a rotated central.

The appliance for retracting the cuspid demonstrates the force applied so that it is drawn distally without affecting the bicuspids or molars. The appliance for rotating the central demonstrates the force applied to it without affecting the other teeth. Fourth, I have a constricted arch. This appliance demonstrates the force applied so that the whole arch is spread, and at the same time draws the incisors distally. Fifth, I have an upper protrusion. This appliance demonstrates the force applied, so that the incisors and cuspids are moved without affecting the bicuspids and molars. The next appliance is for elongating an incisor or cuspid where a small portion of the incisal edge has been broken by accident, but not enough to require restoration. This appliance was designed and constructed by Dr. Alex Jameson, of Indianapolis.

I will only speak of a few of the uses of the flexible rubber dummy in teaching operative technic, for Dr. Webster demonstrated the use of this dummy at Cincinnati in 1898. The interproximal space is filled with a soft elastic substance which approximates the natural gum. This allows the cervical margin of the cavity to extend under the "gum margin." The teeth are arranged as they are in the mouth. The student can see to a better advantage why he should make the margins self-cleansing. He also gets a clearer conception of preserving the contact point, and the principles of wedging. He is working in proximity to the other teeth, so that he must insert the filling material more accurately. He can be taught how to adjust the rubber dam and the use of ligatures. Also the application of all kinds of rubber dam and cervical clamps. With properly constructed dummies he can also be taught the different motions used in extracting.

I consider the flexible rubber dummy to be the best appliance to approximate the mouth for crown and bridge technic. A few of the advantages are: The crown can be constructed under the same conditions as though the student were working for a patient except treating the pulp canal. There is a free gum margin to which he can fit the ferrule almost as accurately as though he were fitting it in the mouth. He gains the experience of shaping the tooth. The interproximal space is filled with an elastic substance, which gives the same effect as gum tissue. The contact point can be preserved as well as in the mouth. Take the construction of a Richmond crown as an illustration. The root is properly shaped and the canal enlarged. The ferrule is fitted to the root and an impression of the ferrule and adjoining teeth is taken. The crown is constructed from this point just as though the work previous to taking the impression had been done in the mouth. When the crown is finished it is fitted to the dummy. The student can now see if the crown has the proper alignment, length, contact, etc. All shell crowns are made on the dummy, using the same principles as though they were made in the mouth. The dummies for bridge technic are constructed to represent partial dentures. There are the same advantages for this work as in crown technic. The method is to construct the crowns, fit them to the dummy and take an impression. Construct the bridge from this point as though it were for a patient. When the bridge is completed it is fitted to the dummy for final adjustment.

I said in the beginning that the use of flexible rubber dummies is in its infancy. I see several improvements that I expect to make next year. One change in my crown and bridge technic will be that each freshman will construct a full upper and lower denture, the lower to be preserved for use in the junior and senior years. The junior constructs the flexible rubber dummy for crown technic to occlude with this lower. The senior constructs the dummy for crown and bridge technic to occlude with the same lower. By using this method of constructing the dummies, all crowns and bridges can be made to an occlusion.

I find the edentulous flexible rubber dummies mounted on an anatomical articulator very valuable in teaching prosthetic dentistry, as well as prosthetic technic. These dummies are mounted on Gritman articulators, giving the lower jaw the natural movements. I use these dummies in the following way: Each freshman takes impressions of them in plaster of paris, constructs the casts, and base plates for the bite. He then takes a base plate bite of the dummy. The length of the bite is determined by arranging the set screw on the articulator. He then constructs the dentures from this point as though they were for a patient, and when they are completed he fits them to the dummy. You can see by this base that the finished work fits the dummy quite accurately. Each junior takes impressions of this style dummy to obtain dies and counterdies for constructing swaged metal bases. I have here another set of dummies mounted on a Gritman articulator. The upper represents a flat mouth with a hard palate. I failed to get the results I hoped to obtain with this, but the effect of the hard palate is fairly well shown. The lower represented a ridge with marked absorption. I have a number of dummies like this which the freshmen take impressions of, for constructing cast metal dentures.

There are a number of advantages for using the flexible rubber dummies mounted on Gritman articulators. They can be made to approximate the mouth better than metal dummies. Plaster impressions can be removed from undercuts. The student can see the possibility of the patient protruding the lower jaw or closing laterally when taking a bite. A series of dummies representing mouths from the normal to the abnormal can be made. By vulcanizing the metal bows in the dummies one set can be removed from the articulator and another be adjusted without any inconvenience. The bite can be raised or lowered, and the dummies can be arranged to represent an upper or lower protrusion. A large number of similar dummies can be constructed from the same mold, so that any number of students can do the same work at one time.

The next dummy is used to take impressions of, for constructing appliances for cleft palate. This dummy is very crude, and I hope to have a better one to present to you next year. As far as I am able to learn, the construction of appliances for cleft palate has not been added to a technic course until this year. Each college has a number of cases of cleft palate during the session, but this class of work is so limited that only a few students get the practical benefits. I have a number of dummies of which this is a fac-simile. Each junior and senior constructs an appliance with the velum attached to the vulcanite. Next year I propose to have each junior construct a similar appliance, but each senior will construct a metal base with a detachable artificial velum. This gives each student a practical knowledge of the technic of taking the impression, constructing the cast, properly waxing the case, burnishing tin-foil, packing two kinds of rubber, swaging the metal base, constructing the mold for vulcanizing a detachable artificial velum, etc.

I am not satisfied with the method of producing the teeth used in the flexible rubber dummies, for operative and crown technic. A portion of the student's time, consumed in producing these teeth, can be used to a better advantage. Dr. Webster requires his students to carve the fourteen teeth in modeling composition, and then reproduce them in white vulcanite. I require each student to buy two "Weeks" tooth forms. He then dissociates the teeth and reshapes them. It is almost impossible for each student to have typical forms of teeth for the flexible rubber dummy if he carve his model teeth in modeling composition, and then reproduce them in vulcanite. Then it takes too much time to produce the teeth by this method. It is impossible to get typical forms of teeth unless they are reduced in size when they are reshaped from the "Weeks" tooth form. I consider the time required to construct the flexible rubber dummy after the teeth are produced well spent. The student gets the technic of constructing a denture along with the many other practical points.

If a number of colleges can be interested in this method of technic teaching, we can get some manufacturer to furnish the vulcanite teeth at a nominal cost. These teeth will have all the lines, grooves, cusps, ridges, fossæ, etc., on the occlusal surface, but the axial surfaces will be parallel. The student should then shape each tooth, giving it a bell crowned appearance.

DISCUSSION.

Dr. W. E. Grant, of Louisville: I am glad that Dr. Byram has presented this subject to-day. While some teachers, I know, have been using it for several years—some two years, rather, since it was presented by Dr. Webster at Cincinnati, as noted by Dr. Byram, at the same time it contains some additional valuable suggestions that I am certain we can all profit by.

There were a number of suggestions thrown out in the paper as to the use of flexible rubber that had not occurred to me. After the demonstration Dr. Webster gave us in Cincinnati, Christmas two years ago, opening in January, as our school did then, I was able to put it into immediate practice, so that we have been able to use the flexible rubber in the construction of the tooth form, and also in the last two sessions, used it in connection with the orthodontia appliances, and I am glad to commend them very highly. Of course, as Dr. Byram said in the beginning of his paper, all the students are not able to use the same material nor the same methods and accomplish any kind of satisfactory results.

There were some suggestions thrown out in the paper that probably would not be considered practicable by some of those present, but the others, I am sure, they would accept and use, and only would require the use of this flexible rubber through one session to demonstrate the advantage of it in teaching technic in the various departments. There is one trouble, however, in the technic work, and that is something that we have to guard against—the liability of making our men mere mechanical machines. We had better give them less and have them better understand the principles which underlie the subject. Let us not try to have them make too many things in operative technics, orthodontia technics, or in prosthetic technics. What we do require of them extend to the point where they are able to apply the principles. Now our tendency—we talk about this subject of technic so much—is to multiply the requirements all the time, requiring a large amount of work of the student without teaching him what he needs. We want to teach, not simply instruct. The point was made by Dr. Byram that some say why not require the application of these requirements in a practical way in the clinics. I believe, however, that there is no operation of any consequence requiring the exercise of mechanical ability, but what ought to be done in a technic way outside of the mouth before it is attempted to be put into practice in the college clinics. I do not believe, however, that with the short term of three years and seven months this is practicable. Before we can hope to do everything—that is, I mean all operations of any consequence of a mechanical kind in a technic course, we must extend our term at least another year.

Dr. Byram mentioned the advantage in demonstrating the contact points and the restoration of tooth structures in his paper. I want to say that I was not able to have my class appreciate what I meant by the restoration of the tooth structure and the bringing out of the contact point until I used this tooth form. He also laid some stress on the carving of teeth. I like to require considerable carving. It helps to teach them anatomy in a way superior to any other. The question is, how much carving? Thus far we have required them to assemble, or make, in some way, the fourteen teeth, to carve them in the white rubber, and then arrange them and finish them on the black flexible rubber base. I would also say that the flexible rubber is not only valuable made in the forms that Dr. Byram has presented, but also in various other forms; used, for instance, for duplicating purposes, getting out a number of casts—using it sometimes as a base for the making of the various casts, and, for instance, in your prosthetic department, you desire your students to make a certain piece of work, and to make fit the same cast by using the flexible rubber cast it can be accomplished nicely. I didn't notice that suggestion, but we have used it in that connection.

Dr. D. M. Cattell, of Chicago, Ill.: I have but little to say, as the subject is one that I know very little about, except from the standpoint of technic work. I can only understand the result of the technic training as seen in the orthodontia department of the infirmary. The experience had in watching the result of technic teaching in practice as found in the dental infirmary, and there the teaching that has been previously given in the orthodontia technic should be put in practice.

Ever since there has been work along the line of technics in orthodontia there has been a great increase in the amount of practical orthodontia in infirmaries. A few years ago, and but very few years, in the majority of schools, the regulating of the teeth was almost unknown in the infirmary practice. It has been slowly growing, but it never took a position worthy the name until the technic work was introduced, and after that the practical work was made much more sure.

Now in several schools that I have seen and know of—in fact, the school that I am connected with—the practical orthodontia work is not what it ought to be. Why? Because it has been all but impossible, so far, to get a competent teacher in orthodontia technics.

One objection I shall make to the paper or to the idea given there, which was referred to by Dr. Grant, and that is, the application of the principles involved. Now, gentlemen, my idea is that this paper is on *technics*, and not upon the principles to be applied as taught from the chair. I draw a broad line between the general principles that may be taught from the chair of orthodontia and the technic work of making appliances in the laboratory. When the student knows how to make the appliances, the technique, then listens to the lectures from the chair of orthodontia, he will understand the principles that may be there laid down; but to take principles before he knows how to make the appliance to attach to a case involving a principle, it seems to me that is teaching differently from what I conceive to be the proper way. It has been, as you know, the idea of technic teachers, that the technic work comes first. That technic work is in the beginning of the course, whatever it is, no matter whether it is in the first or second year, the technic first, then the greater principles involved coming after. So that while it is a fact that on these models or on anything that we may produce in the technical laboratory, we cannot so well teach the principles, but our object there is to teach the making of the appliances, how to make them, what to make and so on, and afterward teach the principles. I judge the majority of schools that teach orthodontia technic teach it in the second year, while it is the third year that the principles of orthodontia are taught from the chair, pupils meeting the practical cases in the infirmary. At least, that is as I have learned to understand the way that most schools teach. Some, of course, may teach their orthodontia technic in the first year, but we never expect a student to come in contact with the actual cases in the first year, not until he has passed on to the infirmary or practical work.

Now in regard to the peculiar method of teaching, referred to in the paper, I cannot but think it greatly in advance of many things we have had. As we all know, last year was the first time that the subject of orthodontia technics has been before this organization as a distinct specialty. Dr. Case's paper of last year opened the field, and surely we are growing in that work. The flexible rubber in orthodontia, as well as in other fields of work, is certainly a great advance, and I am glad that it is coming into more general use, and I believe that within a few years, as we know better how to work it and as we find out different things that it may be utilized for, we will find that we cannot do without it. And I have heard of more new things that are to be presented along these same lines.

But the one point that I would like to emphasize before sitting down is this: That it seems to me so many fail to disassociate two ideas. The one, to be presented by the chair of orthodontia or the chair of any subject, and the other, the work done in the technic laboratory—the manual training, the finger craft.

Now we used to call ourselves an association or school of technic workers, and while we were in that, if you remember, we left the greater principles of those things that were in the practical course of the work—infirmary work—alone; while we were working in that technic field it was that we grew. It was our *technic* work, gentlemen, and that alone, that has put us where we are to-day, and had it not been for that technic work, letting everything else alone until we had that well in hand, we would not have been sitting here to-day in the broader field of pedagogics.

DR. ALEXANDER JAMESON, Indianapolis, Ind.: I was informed at this morning's meeting that I was to take up this discussion. I have been more or less familiar with Dr. Byram's work in the past, and I know that he has put a good deal of time upon this, he has been very earnest about it; and it seems to me that if there is any one thing that can be said about it, it is that there is even a broader field for it than he has given us to understand. There have been some objections and some difficulties to be overcome. His idea was to use the ordinary vulcanite tooth form and imbed it in this soft rubber. In speaking of this to several gentlemen the other evening it was suggested by some one that bone or ivory be substituted—that is, that the carving go on as it is in the laboratory and that the carved teeth be used in the forms. Now that cannot be done in one way, and it can in another. For instance, you cannot vulcanize to this ivory or to this bone, but you can make a counterpart of the ivory or the bone in metal and then vulcanize around them and withdraw them and then insert your teeth. In addition to this, I have thought of several new features. I suppose they are new. I think this one is essentially new; in vulcanizing our teeth we can vulcanize them with the root canals in position, and thus teach pathology in a way that we do not teach it now, possibly. There is an old saying that "the grave hides a physician's mistakes." It don't hide the dentist's mistakes, and we know there is very little danger of having too much technic. I think this work is especially desirable in orthodontia technic. There is a little bit of selfish interest connected with this. I hope by next year we will have a number of typical cases made up of this kind, so that—while we do not want, of course, to get the chair of orthodontia and technics together in any sense of the word, if we have a number of models of typical cases—it will aid the lecturer quite a good deal in just that kind of work.

Dr. A. E. Webster, Toronto, Can.: I understand that Dr. Byram has devoted, in fact, all of his time to this work of technic teaching, but it is only what we may expect, just so soon as a school comes to the conclusion that they will employ teachers to give their whole time to the subject they will produce something that will be valuable in the line of teaching; so in this case, and you may expect in any school where you have men devoting their time to teaching, and think of teaching twelve months in the year, they are likely to produce something at every meeting that we have that is of value in this work. I wish to thank Dr. Byram for a great number of suggestions that he gave here over anything that I have done in it myself. Then, again, there are some suggestions that will be brought forth later in the meeting that are different from these, that we may consider very important. There are a few things in connection with this orthodontia question, Dr. Cattell said, with reference to the teaching of orthodontia not being what it was desired in a great number of schools. I have charge of that department, and I can tell him why it is not up to the mark in our school, is because it is so difficult to teach. I never tried anything so difficult to teach as it ought to be done. It seems so hard to get a sufficient number of examples to show to the students, of the work that you are trying to do, to demonstrate the principles.

Now, first, is the difficulty—spoken of also by Dr. Cattell, of separating entirely technic from principles. Now, just as soon as you do that you will lose the interest of your student. "What has this work to do with dentistry?" you are asked immediately. And I will tell you, that is a stumbling block. The student must know at every step what the question in hand has to do with dentistry, and if he does not know he should be informed, and then he is interested, and without that interest you would do nothing—you might just as well be talking to the wall. So that in every step, no matter what you are teaching, that man should know exactly why he is doing that work. I should not think of asking a man to carve a tooth without showing him plainly where he would need that work; and, in fact, I never ask a man to do anything; he desires to do the work prescribed. I ask one of the boys, why are you doing this work, why are you carving this tooth, why are you doing this particular work, why are you making this nut, why are you making this tap—he must know. If he doesn't he will have but little interest in his work and will not do it well. If you are going to make a mere mechanic out of a man and want to give him a good finger technic for it, very well; but why not make the subject alive at the same time by giving him an interest in his work.

The lapping of one chair over another is a difficult question, and it will always be hard to solve until one man has charge of the whole work from the very bottom or freshman class to the top or graduation; if a teacher is good enough to give the first ideas of a subject he is good enough to give the last ones of it, because the first ones are the ones that stay. A man is never too good, never too brilliant a teacher to teach by the demonstration method. I never saw any one yet who was too brilliant a teacher to waste his time on a demonstration. In fact, he will teach more by a demonstration than he will by all the words he will ever use in that connection.

I wish to thank the gentlemen for their attention; and I wish to thank Dr. Byram for his paper.

DR. O. A. WEISSE, Minneapolis, Minn.: I was glad to hear what Dr. Webster had to say in regard to the difficulty of teaching orthodontia technic. None but those who have had experience can realize how difficult the subject is. It is not at all strange that it should be a difficult one; it is one of the newest subjects that we have in dentistry. It has not been reduced to exactness like some other subjects have been, and that is one of the reasons why it is difficult.

I believe that the best way is to teach the technic first and the principles of orthodontia afterward. Have your technic simple. The method that I pursue is this: I make up a case of the common forms of irregularity in order to avoid having to make so many casts to illustrate each of the appliances. As many appliances as can be put on to one cast are applied, and the rest of them are applied on another cast; but every student is given to understand that each one of these appliances is to illustrate a certain principle and each case of irregularity is either a simple one or a complex one, and when they have made the appliance they see at once just what that appliance is to do.

The principles involved in correcting irregularities are all left until the third year. I do not think that it is the proper thing to give the student too many things at one time. We must remember that while some of our students graduate from high schools and some from universities, their minds are young ones, after all, in this line of work, and if you try to put too much before them at once you confuse them. It is all well and good to interest them, but there is a limit.

DR. J. D. PATTERSON, Kansas City, Mo.: I wasn't going to say a single word after Dr. Webster spoke, because he expressed my views precisely in regard to some remarks Dr. Cattell made; but since Dr. Weisse has so strongly reiterated the statement made by Dr. Cattell in regard to the importance of disassociating the technic work and the teaching of the principles for which that technic work is undertaken, I want to express my wonder how such a stand can be taken by a logician or by a scientist. We must *associate* them, not *disassociate* them. They have said, both of them, with a great deal of impressment, that they must be disassociated, and yet have not given one single argument for that separation. I do not wish to take up time any longer.

DR. THOMAS E. WEEKS, Minneapolis, Minn.: I think the gentleman who last spoke misunderstood Dr. Weisse, or else Dr. Weisse did not make himself clear. In the first place, Dr. Weisse teaches both the technic and the principles, and he simply dissociates the time, not the principle and the technic. The principles go all through the technic of everything that is taught by Dr. Weisse.

DR. J. D. PATTERSON: He said he didn't teach the principles until the third year.

DR. THOMAS E. WEEKS: The principles of the movement of the teeth, doctor; he meant to say the principles underlying the great subject of orthodontia, and if you will attempt to put that into a man's head before he becomes somewhat familiar with the subject through the making of appliances which he has been shown what they are for, before he is asked to make them he will make a sorry mess of it, in my opinion.

DR. PATTERSON: Put them both together.

You cannot do it.

DR. G. V. I. BROWN, Milwaukee, Wis: I think these gentlemen have confused two terms; they have confused the term principle with that of practice. In technics you have, of course, principles. All technic work is based upon principles, but I do not think any one would argue that it is wise to mix practice up with technics. When Drs. Weisse and Cattell spoke I think what they meant they didn't wish taken up is that mixing of practice with this matter of technics.

While I am on the floor I wish to call attention to one little modification which I have seen fit to make in this work, and I would like to have those who are interested look at it in the exhibit which I have here. When we put the flexible rubber model into the articulator to work upon we have found that it is a good plan to attach a piece of rubber dam, a piece long enough to imitate the cheeks; running from the superior to the inferior model. For instance, in taking impressions, the student inserts the tray as he would in the mouth. We have expected this year to add this feature also to the technic of filling. After a certain number of the fillings have been put in we expect the last five to be put in with this imitation mouth. He has to fill this tooth in a darkened space, very much like the mouth—about the same opening; his hands, of course, have to be used to hold this flexible cloth away and hold a mirror, much as he would be obliged to do in working in the mouth.

Dr. A. E. Webster, Toronto, Can.: I want to say something in reference to what Dr. Brown has stated. While in Paris I noticed a head for teaching that same thing, devised by Mr. Brunton, of Leeds, England. This head is put on the market for sale, I think, by the Dental Manufacturing Company, of Great Britain, with that same idea, only it contains natural teeth in Mellott's metal, which are then set in the jaw, and each student having a set of teeth in that way, which he puts up and articulates, and when it comes his turn to operate they are set into the lower jaw, while with other appliances just the same as Dr. Brown spoke of. The head is strapped to the head rest of the chair, if I remember correctly. It seems to be a very nice device, but the price is away beyond anything. I think they asked in the neighborhood of £5 for each one of them. I thought at that time, if they were only reasonable in price, of making these rubber tooth forms that we have here so that they might fit into the jaw, upper and lower, of that head made by Mr. Brunton. Some of the gentlemen here, of course, have seen it; they will understand how it might be done.

Dr. H. B. Tileston, Louisville, Ky.: I want to ask if by setting these teeth in flexible rubber and then applying these mechanical arrangements for regulating them, you can simulate the movements that you will obtain by the application of that same force on the natural teeth. If not, I do not see any advantage in the flexible rubber over the use of plaster of paris casts.

Dr. Byram: I will demonstrate that. Here I have four different appliances for doing different things, and I will show that they will do those things.

Dr. Brown: For fear somebody might think that I was claiming to be the originator of the idea, I wish to state that Dr. Carpenter was the gentleman who gave me the suggestion. I have never seen it applied except as we apply it. There is no expense to it except the rubber dam and the fastening that is necessary to make the articulator firm to the bench at which the student works. That, of course, is a simple matter.

Dr. George E. Hunt, Indianapolis, Ind.: My knowledge of orthodontia is just about on a level with my knowledge of Hebrew, so I have nothing to say on that subject, but there is one thing that has not been discussed yet, and that is the application of these models to the teaching of operative dentistry. I see quite a number of such teachers here before me, so I want to tell you some nice things that can be done with these models. All of you have, no doubt, commenced a talk on the application of the rubber dam, or of cervical clamps, and found your class all inspired with the simultaneous and instantaneous desire to go to sleep. Anything so commonplace as that is of no interest to them; because they have seen it done once or twice, they believe they know more about it than the man in front of them; but if you have one of those tooth forms with which to demonstrate these things, in the hope that you will make a mistake in the demonstration, they will watch you very closely. So I adjust the rubber dam on the tooth form before the class. I also apply the several different sorts of clamps on the model. I illustrate the removal of salivary calculus and the various methods of separating the teeth. The simplest and most common methods of approved procedure can be better impressed upon the student by the use of one of these tooth forms than by the most eloquent flights of oratory that you are able to bring forth. These tooth forms ought to be passed around here. Dr. Tileston don't know the great advantage of them. I have learned a great deal about orthodontia myself in inspecting these models.

Dr. Byram: Here is one which has two floss wedges, a wooden wedge and an elastic wedge. Here is one with an appliance on. You can see how it has been moved labially, showing the rubber through. Here is one with a mechanical spreader; these teeth were in actual contact when it was placed. Here are some demonstrating the use of cervical appliances. I have three different appliances here—simply brought them to illustrate. I came up hurriedly from my room and left my wrenches, but I can show you later that by moving these nuts you can see by the rubber how the teeth have changed. You will see that this labial protrusion was quite prominent when the appliance was placed on it, it has been drawn in. Here is one that had a labial protrusion as well as a restricted arch, and the arch has been widened by the appliance.

Dr. Hart J. Goslee: I do not like to see this subject passed without taking occasion to agree with the sentiments expressed by Dr. Webster in that it is not possible for a teacher to dissociate technics and principles in his teaching, if he wishes to serve his own and the best interests of his students. The minute you do dissociate them you make a veritable machine of the student in his technic work.

I know that this will not coincide with the views of many of my good friends here, because Dr. Hoff and I had a little discussion a couple of years ago upon that same subject, but I am quite confident that personally I would not be as successful a teacher in my line of work unless I did associate the two as I went along.

I want to say a word of commendation with regard to these most excellent models, both for myself and for Dr. C. S. Case, of Chicago, who regrets that he is unable to be present. Dr. Case is very much taken up with these models, in their application especially to the teaching of orthodontia, and requested me to say to Dr. Byram and to this association that he thought it was the greatest step we had yet made in the teaching of orthodontia, because of the fact that the models could be made placing the teeth in them in the relation we find in common irregularities, so that the various typical appliances could be constructed and adjusted and the application of force and its effects noticed. Of course, you do not have the exact conditions you do in the mouth, but you more nearly approach them than you can in any other possible way.

I believe one of the most valuable things we can add to the teaching of technic work is to have the conditions under which the work is done as near the natural condition as possible.

I want to commend the paper and the models Dr. Byram has presented most heartily, and will say incidentally that I have figured out a little scheme which will enable me, I believe, to produce a set of typical teeth to be used in this work very easily, without much expense, and have them almost anatomically correct, and I am going to promise to construct a set in a very short time and submit them to teachers in this line.

Dr. H. C. Kenyon, Cleveland, Ohio: I wish to heartily second the remarks of Dr. Goslee as just made in regard to separating the teaching of the principles and the technique entirely. I do not understand from the remarks that they have made that Dr. Webster or Dr. Goslee would expect that the technic teachers should take the burden off the shoulders of the head of the department whose work he is demonstrating; but it is not long since I was a student myself and I remember very distinctly that my mind was in a mood, when I was being taught to make an appliance in the laboratory, to receive some instruction concerning the principles that were involved; and I believe that if you will teach the student why he is doing the work and give him some of the principles at that time which perhaps properly belong to the didactic teacher, they will become more permanently fixed in his mind than if given at any other time. I believe there is no other time at which he will receive this instruction so well and remember it so long. And it ought to be a great advantage to the didactic teacher to have had this done before the student comes before him in the lecture room.

Now another thing that I wish to speak of is in regard to the use of these rubber forms. I find that there are a great many more men using these forms than I supposed there were; but I suppose there are quite a number of schools yet that are not using them and have perhaps not seen the advantage of it. We are not using them in our school, but we hope to use them in the future. Some of the gentlemen present have learned a great many items in the making of them; and I should like to ask Dr. Webster or Dr. Byram if there is anything in print, any description, if they have written anything for any of the magazines describing the details of preparing these rubber forms?

Dr. Byram: It comes out in another paper.

Dr. Kenyon: I am glad to know that, for it will be of very great value to have the detail of the work of preparing these models given to us.

Dr. D. M. Cattell: I wish to set myself right—at the same time I do not propose to take back anything I have said. When we teach instrument technics, when we teach the students the making of instruments we do not go into detail and tell them at the time they are making instruments for manual training. for technic purposes, the different forms of cavities that a particular instrument may be worked in. We teach a great many things in the technic laboratory and yet not touch on the greater principles, that the technic work when completed may be passed on and worked into the theory and practice of the principle. I feel that I have Professor J. Liberty Tadd back of me in this idea, a man whom some look up to very highly. It is the finger first. Now, in regard to what Dr. Patterson brought out so boldly: I am not a logician, but I did not suppose it was necessary to have to explain that certain *mechanical* principles had to be recognized in the making of an instrument. I was talking of those great principles underlying practical orthodontia. As technical teachers, when the student first comes into the department of orthodontia technics we do not expect to go into the etiology of irregularities and the principles underlying articulation, and that certain influences will direct teeth in certain directions so that they keep on moving and get in a wrong position in time; we do not wish to touch upon the principles of moving those teeth. The principles involved in the stretching of the process, and in bending the process and holding it there until nature takes hold and finishes the work; those are the principles that I speak of. It was not that where we turn a screw to the right that it will shorten a bolt, or that we make a cylinder and put a bar through that and a traction screw on one end it will pull two things together that that bar is attached to. I am not talking about those principles; those are simple mechanical principles that should have been learned in the high school. It was the physiological and pathological principles that I understand the paper involves, that he must teach the chair of orthodontia in the technic laboratory, and that I object to, and I have J. Liberty Tadd to stand back of me.

It is the idea that what belongs to the professor in the chair of orthodontia should be taught in the *technic laboratory* that I object to.

Again let me hint to you that the teachings of Professor Tadd will bear me out in the view of the method that should be followed.

Dr. Brophy: I just want to say that the great lesson learned in this extremely interesting discussion is that those of us who are in favor of extending the course of instruction to four years have had sufficient evidence to-day, that such a course is absolutely necessary, in order that our students may have time to learn all about this subject as well as other subjects taught in our dental colleges. The course must go to four years. There is enough in this course, gentlemen, to take up the time of a student two years if he did nothing else, and how can we expect to teach all that is before us in the brief period of three years?

Dr. J. Q. Byram: I am certain that I was misconstrued in the paper, both by Dr. Grant and Dr. Cattell. The one object I had in view was to keep from making a machine of the student. Dr. Grant fears that there is that tendency by my work. Now, the whole idea in my work is to get as near to the natural conditions as we can, and by so doing relieve the student from the monotony of working on a plaster of paris cast where his work produces no results. We give him something better to work on, and I do not believe that is making a machine of the man. It is lifting him a stage higher.

If any of you doubt that I can do what I have claimed in this paper, if you will come to me later, I will prove it to you. And another thing, about the carving. It is a very good plan to allow the freshman student to carve his teeth, but now I am introducing these models in junior and senior work. I am introducing it in the junior year for orthodontia as well as for crown work, and in the senior year for crown and bridge work. Now, I believe that the time spent in carving teeth either is or can be better spent somewhere else, and for that reason I suggest we have a better method of producing these teeth.

With reference to the remarks of my friend Cattell I must say I was really surprised. I believe there is something wrong with him. I haven't seen him for a couple of years, but it seems to me he talks rather different from the way he did the last time I saw him. If I have to teach technics in our school and be a parrot, I want to quit to-day. When you take the individuality out of a teacher how can you expect him to arouse individuality in his students? If I am simply to follow my chief professors and do what they tell me to do, or not advance a stage, I want to quit teaching. I want to teach as I want to teach. If I see things that I think are good, I am going to teach those things. I don't care whether those fellows want me to teach it or not.

A MEMBER: You are a kind of anarchist now—you want to be the whole thing.

DR. BYRAM: Not at all. As an illustration, my friend Dr. Hunt has operative dentistry. When I teach that part of the technic work I teach it as I think it ought to be taught. Of course, we teach together, but Dr. Hunt does not say to me that I shall teach this or I shall teach that with regard to operative technic. No man can teach anything unless he teaches principles along with his work. Now, in orthodontia you may show plaster casts, and tell your students that these appliances will do certain things, and produce some impressions, but if you will attach the appliance to one of these tooth forms and demonstrate to him the effect it will have on the tooth, he will get a far better idea and be more deeply impressed.

TEACHING OF MATERIA MEDICA AND THERAPEUTICS —HOW AND HOW MUCH.

By A. H. Peck, M. D., D. D. S., Chicago.

This subject is, I presume, rated by the majority of teachers in dentistry, and certainly by the vast majority of students of dentistry, as the driest and most uninteresting of the entire college curriculum. Why this is so, I cannot tell. I can only leave you, who are especially interested in this work, to draw the inference. As for me, I would not exchange my position as teacher of materia medica and therapeutics for that of any other in the list of instructors. This work is anything but dry and uninteresting, as I find it. I see in this field opportunities for original research, for a broadening of one's mind, for an extension of one's knowledge, for a general rounding of one's mental capabilities and character, as are found in very few, if any, of the other departments of our college work. And surely the individual who is unable, in the light of such possibilities, to present his work to the students in such a way as to command at the very outset, and to hold throughout, their respect and interest, is certainly not the kind of individual referred to by the gentleman who said, "Poets are born, not made." For this saying applies just as truthfully to the teacher as it does to the poet.

One of the first and most important questions to be considered in a paper of this character is, just how far should we, as teachers of dental students, carry our pupils in this great field—materia medica and therapeutics? Are we justified in being content to teach them just enough to enable them to treat locally, reasonably well and with a respectable degree of success, the various pathological conditions about the mouth? Or should it be our aim to so instruct them that they will at once be able to recognize and intelligently prescribe for the various systemic disorders that are constantly aggravating the local pathological manifestations; and, indeed, many of which latter are only indexes to the systemic disorders? My answer is most emphatically in favor of the latter course. Please do not understand from this declaration that I would have the dental student subjected to as extended a course in materia medica as is required of the medical student. However, I am strongly inclined to the belief that this phase of the question should only be qualified by the unfortunate condition invariably imposed upon us, namely, lack of time. Surely, no one can deny that three years of six, seven or eight months each is insufficient time for the student to become thoroughly learned in all the branches now included in our curriculum; consequently it only remains for the work in some of the departments to be cut down as much as possible, and perhaps chief among these is materia medica and therapeutics.

Nothing grieves me more than to hear, as we frequently do, from the older members of the profession, the leaders, those to whom we are accustomed to look for guidance and inspiration, this sentiment, that it is a mere waste of time to teach the dental student more materia medica than is necessary to enable him to treat, reasonably well, the local manifestations of trouble about the mouth.

What would you think of a man enjoying a lucrative practice in a large city like Chicago, or elsewhere, for that matter, merely treating with local remedies the local manifestations in the mouth of a case of syphilis, and never even thinking that this disease calls for systemic treatment, to say nothing about possessing the knowledge to prescribe for it? More than one case like this has come to light.

The very logic of medicine lies in one's ability to recognize the primary action of drugs upon the various organs and through the great systems of the body, the secondary action upon other organs, and in this manner having an indirect but important bearing upon the local pathological manifestations. Thus is one enabled to note the parallelisms existing between the action of drugs and the pathological conditions in disease—a very fascinating study indeed.

Let it be understood, then, that we favor, first, the teaching of those drugs with which the student will come in contact daily in his practice, such as the antiseptics, disinfectants, germicides, escharotics, counter-irritants, styptics and local stimulants.

Next in importance is a thorough knowledge of at least the standard remedies that may be indicated for the alleviation of such systemic disorders as may in any way aggravate or effect the local diseases or pathological manifestations under treatment; then, a thorough knowledge of the circulatory stimulants and depressants; the respiratory stimulants and depressants; the nerve stimulants and depressants, is essential. The hæmostatics, diluents, antiphlogistics, cannot be passed by with only a superficial consideration.

Then the most important of those agents which assist to the performance of better work by the digestive, assimilative and eliminative organs—the last comprising the sudorifics, diuretics and cathartics. Local and systemic antidotal treatment is of the utmost importance, and the intelligent prescribing of these medicines must never be neglected.

Two important questions now present: How much regarding these various agents shall we teach? And how best may we teach it? In answer to the first question, I will say we cannot teach too much about them. For example, in considering laxatives, while I would teach the principles governing catharsis thoroughly, I deem it unnecessary that dental students be familiarized with the entire list of remedies in this division, but with the principal ones he should be as familiar as should the general practitioner. The same may be said with even greater force of circulatory and respiratory stimulation. I cannot emphasize too strongly the necessity of being thoroughly familiar with the principal agents or means in these two divisions. The exigencies that sometimes arise while administering anæsthetics, either general or local, constitute an argument that should convince all of the soundness of the above statement.

This naturally leads to the thought that one should be familiar with the various signs, symptoms and indications of a failing heart or of failing respiration. The latter, in comparison, is easily detected, hence the more stress should be placed upon the former.

The pulse, when properly understood, is a reliable index to the condition and action of the heart. I deem it a necessary qualification of the practicing dentist to be able to recognize, through the medium of the pulse, serious diseased conditions of the heart. There can be little doubt that failure on the part of dentists to recognize these conditions through the medium of the pulse is responsible for many serious results, especially in the field of anæsthesia.

Our students should be thoroughly learned in this particular line of symptomatology. Let them be taught what intermittence, irregularity, compressibility and dicrotism of the pulse mean. And especially the characteristics of the pulse and their meaning in actual lesions of the heart. Let them understand that if the pulse is quick, sharp, thready, shot-like in its manifestations the patient is likely suffering from aortic regurgitation or is in a highly tense nervous condition, and should be dismissed at once lest serious consequences result.

Familiarity with the various manifestations of the pulse and their meaning as to the condition of the heart and nervous system seems such an important matter to me that I could not forego a brief reference to it.

It is true dental students should be well grounded in the pharmacology, source, constituents, physical characteristics and properties, physiological action—and this, too, in its broadest application, therapeutic value—this being perhaps the most important of all, and dosage, when indicated, of all the various agents to be considered.

An individual consideration of these agents or groups of agents, however desirable, is out of the question in the time allotted to this paper.

In answer to the second question, How best may we teach this? I will reply that no one rule or set of rules can be followed successfully by all. As indicated above, teachers as well as poets are born, not made, and each one will find it necessary to follow the guidance of his own personal capabilities and characteristics.

No method of teaching can be more effective than that which renders the work of study a real pleasure to the student, and surely no other can be more pleasing and satisfactory to the teacher. One year ago I conceived the idea of having a student prepare a paper on a subject pertinent to the department. A number of other students were to be selected to discuss the subject, and were expected to prepare themselves for this purpose. Occasionally during the term an hour was to be given to the class for the reading and discussion of these papers.

When other members of the faculty were told of the plan, all were agreed that it would be excellent work if successful. Some offered encouragement, while others were so pessimistic in their views as to express it as their opinion that failure would result. Never having given much prominence to that sort of a turn in life's affairs, I determined to make the work a success.

A good student, and one whom the balance of the members of the class respected, was selected to prepare the first paper. Five or six others were selected to discuss it. An hour was set apart for the reading and the discussion of the paper. It was noted during the days intervening that these students were in the library at all unoccupied hours, looking up the literature—not only these, but many other members of the class. They were making thorough work of the preparation. And suffice it to say that the exercise was a grand success. The entire class entered heartily into the spirit of the work, and no such thing as failure was to be thought of for a moment.

Several such exercises were held during the term, and I can truthfully say that nothing in my college teaching has afforded me more genuine pleasure or has resulted in more real benefit to the class than has this work.

In my individual work I find the recitation plan of inestimable value, the source of the drugs, their physical characteristics and properties, their chemistry and dosage being almost exclusively taught after this plan. The physiological and therapeutic action of the agents is taught by lectures and by demonstration. However, ofttimes I find the recitation method peculiarly adapted to this division of the work also. We should strive to make our teaching in these two phases of our work just as interesting to our students and as thorough as possible. It is of the utmost importance that we be able to select the proper drug for a certain form of disease. Blundering in this respect is inexcusable, and often results in the most serious consequences. And to understand clearly just how these agents are affecting the various organs through which they are passing on their disease-healing mission is important and necessary to an intelligent use of them.

Soon after assuming the duties of this chair in college work I became especially impressed with the many shortcomings of our various text-books. Indeed, any one who has taken the trouble to look into this question will agree with me when I say that one only has to consult another author than the one that does not suit him to find teaching to suit his own particular fancy, so at variance are the statements of the many different authors pertaining to these various questions in materia medica and therapeutics.

Their lack of harmony as to the relative potency of the various antiseptics and germicides, and their almost total lack of any consideration as to what special agent, under certain conditions of irritation, inflammation, sepsis, or otherwise, would be more desirable to use than another, especially impressed me. I consider it of the utmost importance that students and practitioners shall become possessed of knowledge that is accurate regarding especially the essential oils and other agents we are daily using. We should know their relative value or potency as antiseptics, deodorants and germicides. When we select an agent to place, perchance, in the root-canal of a tooth, it is important that we be familiar with its relative ability to perform the work required of it. Not only this, but I consider it equally important that we should know the action of these drugs on the soft tissue with which they may come in contact. The antiseptics and germicides are poisonous to the vegetable cell. They are used in our work to inhibit the development of and to destroy the germs of disease. Many of them are, as well, poisonous to the animal cell. No one will question the great value of being able to select an agent for a certain case that will destroy the germs present, render the parts aseptic, and at the same time will remain harmless in contact with the soft tissues. Ofttimes it is desirable that an antiseptic or a germicide be used that is also stimulating to the diseased tissues, causing them to yield more readily to the healing influence of the drug. Again, it may be desirable to use one of these agents that imparts a depressing effect upon the soft parts. How are we to make these selections with judgment and certainty without an accurate knowledge of their action when confined in contact with soft tissue?

That I might have something definite to work upon; that I could feel, when I went before my class and made certain statements in this connection, that I could verify those statements by actual demonstration, I have adopted the following plan of teaching these phases of the subject:

During each term a thorough and complete series of tests is made in the bacteriological laboratory and before the class to determine the exact relative value of these agents as antiseptics and germicides. Also an exhaustive series of experiments has been conducted on soft tissue, both animal and human, while in both a pathological and normal state, to determine which are irritating, stimulating or depressing, that we may make our selections for special use with wisdom and certainty.

I believe the same individual who teaches therapeutics should teach special pathology. The two fields are so closely co-related that it is impossible for a teacher to give a comprehensive course of instruction in the one without trespassing more or less freely on the other. Since special pathology has been assigned to me in connection with therapeutics, I find I am able to present the work in a much more interesting manner than I otherwise could do. The students unquestionably gain a clearer and more satisfactory understanding of the various diseased conditions, their pathology and therapeutics, than was formerly possible.

Throughout this brief paper I have hinted at the value of object teaching. I wish now to emphasize this method as strongly as may be. No one can deny that more thorough and satisfactory work can be done by object teaching and actual demonstration, where the nature of the work admits of it, than is possible through the medium of lectures. Suppose it is our purpose to teach the class the effect of a certain drug upon the various organisms, and for purposes of illustration we will consider a cardiac and respiratory stimulant. We go before the class, and in language that is simple, plain and cannot be misunderstood, tell them the manner in which the drug affects the circulatory system and the organs of respiration. That they act directly upon the nerve centers in the medulla and through the medium of the vaso-motor system of nerves stimulate the muscles of the heart to greater activity, thus increasing the force and frequency of the pulse; and that they act, through the medium of the circulation of the blood, upon the respiratory organs, stimulating them to greater activity, thus deepening and lengthening the inhalations. Again, a suitable animal is provided, placed upon the table in appropriate manner, is anæsthetized that it shall not suffer pain, then with the knife and appropriate apparatus these internal organs under consideration are exposed to actual view; the students see them in operation performing their natural functions. Now the stimulating agents are administered and the students see their effect upon these organs. In turn they are taken to the laboratory and required to make the demonstration themselves. Do I hear any one ask which method of teaching will make the profounder impression on the student's mind? Personally I can see no comparison. The simple pleasing word picture as presented by the "successful" lecturer makes but a passing impression on the mind of the average student. This cannot be called knowledge—only transient information. The actual demonstration which he has made and observed makes a deep and lasting impression on his mind and imparts to him knowledge that is his own, and is permanent.

We do not even think of instructing students in anatomy purely by lecturing to them on the subject. The institution to-day that would advocate that would be laughed to scorn. No; we take the student to the dissecting room and there teach the subject by actual demonstration. What would the teaching of chemistry amount to without the laboratory? And the same in regard to the teaching of metallurgy. It is unnecessary for me to follow this line of illustration farther.

It seems to me the statement that object teaching in all branches and departments of our college curriculum which admit of it is the only truly effective method to be employed. We must work into this manner of teaching more and more if we desire to make the best return for the favor and patronage of students. I confidently hope and expect in the near future to see a general move toward laboratory methods along this line in college work.

DISCUSSION.

DR. JAMES TRUMAN: I am so much in harmony with the major portion of the paper of Dr. Peck that I feel somewhat at a loss to discuss the subject except in a few commendatory words.

All true teachers must agree with him that the subject of materia medica may be made the least interesting in the curriculum, or it may be made one of the most valuable. This all depends upon the teacher. Many of us may recall the early student experiences when the mere memorizing of the various drugs was the principal part of the study and the miserable hours spent over the effort is not the least of the unpleasant experiences connected with the student's work.

The idea which the essayist endeavors to enforce that the study should be made broad enough to include in its therapeutics systemic conditions, is not one that will be generally accepted. In a general way this should be taught, but until dental students have received a thorough medical education, in connection with the dental curriculum, this does not seem to be possible, nor, under present conditions, would it be proper. There is a positive dividing line between the practice of dentistry and medicine, which, to overstep, means a conflict between the two professions. It is certainly true that the teacher of materia medica should give in a general way information in regard to the "circulatory stimulants and depressants, the respiratory stimulants and depressants, the nerve stimulants and depressants, etc.," but I cannot agree with the paper that it necessarily follows that the dental student should treat a failing heart or syphilis. The time is altogether too short and the dental student has too much to ingather into his brain, to permit a sufficient knowledge to warrant the practice, presupposing it to be a proper course to pursue. The teacher of materia medica and therapeutics has not the time for this, and that which he does give is simply partial culture and superficial knowledge is always a dangerous knowledge.

We are met in discussing this part of the subject with the much considered topic, must students be medically educated to practice dentistry? This is not the place to enlarge upon this, but the idea of the essayist, if practically carried out, must lead directly to the one conclusion, that the degree of doctor of medicine must be the one degree of the future. It is surmised that very few of us are prepared for this.

The essayist's plan of having the students prepare papers and then discuss them is an excellent idea, but it is to my mind impracticable with very large classes. As nearly all dental colleges now have student dental societies connected with them it would seem very appropriate that this should be delegated to these bodies.

The recitation plan, and by this is understood a thorough examination of the students at every lecture, must be accepted as the most important part of the work. It is the only way this subject can be made interesting and at the same time be thoroughly taught. The teacher must do the work that the text books specially fail to do. These books are necessary, but the teacher that depends on them has not the true conception of what is needed in the instruction of this branch.

I fully endorse the idea that materia medica should be combined with special pathology, and, for this reason, would take it out of the first year, where it is generally found, and place it in the second. The two subjects then can be more appropriately combined.

Thus far I am in general agreement with the interesting paper, but must part company with the essayist when he advocates the demonstration of the drug effects on living animals. My experience as a student, and subsequent observations, confirm the conclusions that if such experiments have any value they are confined solely to the operator. It is impossible for the occupants of the benches to see the result, and they must accept the word of the teacher. The effect of these operations upon young men is demoralizing. They come to regard animals as their legitimate prey, and the natural brutality and destructiveness is fostered and encouraged. If vivisection is of value, it must be limited to the discovery of the cause of disease and the proper therapeutic measures to meet it. To make it part of every lecture to determine well known facts, is, to my mind, a violation of all the best feelings of our higher nature. It is, therefore, with extreme regret, as I view it, that the essayist advocates this as an important portion of the dental curriculum and of the teaching of materia medica of which, in my judgment, it forms no part.

No allusion is made to the study of pharmacy in connection with materia medica. In my opinion this should come in the curriculum after a theoretical study of the subject, the year following. This would give one year to the theoretical and one to the practical.

The attempt of some teachers of materia medica, and apparently advocated by the essayist, to extend the subject to include all drugs directly or remotely connected with dentistry, seems an error of judgment. A large percentage of the materia medica of to-day is made of agents that have become obsolete, and to study them is a waste of time both to the teacher and student. The need of the hour is the use of agents in harmony with present medical knowledge and directly applicable to the treatment of pathological conditions met with in dentistry, and in accord with the advanced conceptions of disease.

It is evident that with the constantly increasing demands upon the dental curriculum, there should be an active effort to bring about a lengthening of the time. The schools cannot teach dentistry and medicine in three years, and, as things are at present, dentistry is suffering to an extent that promises to make the student of the future a sort of hybrid, unable to practice properly either branch of the healing art.

Dr. John I. Hart: I am very glad to have had the opportunity of reading Dr. Peck's paper, and I am heartily in accord with his ideas.

In a paper read before the Eighth District Dental Society of the State of New York, in April, 1899, I said: "I firmly believe when students are prepared to study dentistry—and I mean preparation in its broadest sense—that the time will have come when they will take their M. D. with all that that means, and finally take their D. D. S." Everything that has transpired since that time has tended to confirm my impression. Our work is too important, the necessity for thorough diagnosis and treatment too apparent for our men to be but partially cultured. The only obstacle to thorough teaching in this field is the lack of time, and if a sufficient number of teachers agree with me in that respect we can correct that difficulty in the Faculties Association.

In my judgment there is even a greater necessity for a four years' course to-day than existed when the change was made from two to three years. What would become of our co-workers in architecture if they were satisfied to teach now as they did a decade ago? The artistic has not suffered, but the essentially practical engineering branch has been extended. We cannot afford to let our practical work suffer because our theoretical foundation is broadened. A high preliminary standard, supplemented by broad and thorough college education, will cause the next generation of dentists to be accorded the full measure of respect they will deserve.

Dr. S. W. Foster, of Atlanta, Ga.: I am very much pleased to have seen this paper, and I have listened to its reading. We agree with the essayist, that this is one of the hardest, and, we might say, driest subjects our college faculties have to teach. There has been sufficient said to-day as to the method of the successful teacher. In our experience we must know that any man who attempts to teach who cannot devise means and methods whereby the student may become interested, and in a measure enthused in his particular branch, that teacher is a failure, and the college faculty should select another man for that place.

The next question asked, as to how far or how much we should teach. That is a question, to my mind, as it applies to materia medica and therapeutics, that is only limited by the time regulation of our curriculum. I believe of all the branches taught this is one of the most important. We must admit that. It is the crowning and the rounding, as it were, of every student's professional ability; it fills out and gives to him his true profession; it is the blending, we might say, of chemistry, physiology and pathology. And, as a matter of fact, we cannot eliminate materia medica and therapeutics from our course of instruction while we throw into it more of these other underlying fundamental branches. Therefore, I say that we should add to this all that we can which our time curriculum allows. Of course teaching, especially the most important branches, as referred to by our essayist. This question, then, might naturally be asked, how far should we prescribe? We virtually agree with Dr. Truman in his discussion on that point. We will, therefore, not attempt to discuss that.

The essayist says that the teacher of materia medica and therapeutics should teach special pathology. Dr. Webster has said, this afternoon, in his discussion, "When a man is capacitated to teach one thing, he should be able to teach all things," or words to that effect. He recognizes the fact that no one man can teach all the branches as are taught in the study of dentistry. But that leads to this thought, as we are here, gentlemen, to discuss how to teach. In conversation with our estimable friend, Dr. Black, to-day, and as he has stated at previous times, it is his custom to meet with his demonstrators and discuss the methods of teaching in his school, once a week. I believe that that is a valuable suggestion, as it applies to the teaching faculty. I believe that the teacher of materia medica and therapeutics, the teacher of pathology and the teacher of chemistry should know absolutely what the other is doing with regard to his particular branch. There should be a co-operative work in that respect. If we teach successfully the fullness of our profession, we must have co-operation, and to get that we must have an interchange of thought; and the faculty which does not come together and discuss their methods of teaching particular branches is compelled, in a measure, to have greater or less confusion among the students. We all do not see alike, but if we understand each other before we go before our classes, we can in a measure keep a harmonious feeling in same, and, after all, that is the real success in keeping a school together, in my opinion.

The question is asked how best to teach. I cannot agree with the essayist, as Dr. Truman has said, in regard to making practical demonstrations upon living animals. I cannot conceive of the idea of any one getting a full instruction in that respect. I do believe that the student should know the pharmacology of the drugs which he should handle and will handle in the practice of dentistry, and to this extent, in our school, beginning with this year only (the idea conceived), we are having our dental students go into the pharmaceutical laboratory and discuss with the demonstrator in this respect the pharmacology of the drugs which he will use. My great trouble in endeavoring to teach materia medica is teaching the student the individuality of the drug, and the dose equivalent. Now, all you teachers who attempt to teach this branch, no doubt realize the same thing, and for this reason—to overcome this—we have attempted to throw into this work a little of this pharmaceutical experimentation, and I find that it acts favorably.

Another form, of course, we understand object lessons to be one of the best, as the essayist has stated. In our work we have endeavored to drill the students in prescription writing. The essayist has been having a certain number of the class write essays and discuss them. We have been having three or four or five or six of the students to write prescriptions for certain pathological conditions. These prescriptions are brought before the teacher and the class, and then the relative value of each prescription discussed as it applies to the particular pathological lesion for which it was intended. And I must say that I am particularly impressed with this method of drawing out, and making the student think with regard to the therapeutic application of drugs. They begin, then, to study those drugs, which are compatible and incompatible—and we all know that there are a great many practitioners to-day, practicing in America, who could not write successfully a prescription for many conditions. This practice of prescription writing I consider to be one of the best that I have so far adopted in teaching this particular branch.

Dr. Geo. E. Hunt, Indianapolis, Ind.: It is a privilege to be allowed to discuss this excellent paper of Dr. Peck's. The subjects of materia medica and therapeutics have not received their full measure of attention in dental colleges. One reason for this has been cited by Dr. Peck—the lack of a suitable text-book. I mentioned this fact a year ago in this body, and so far as I know, no effort is being made to remedy the deficiency. None of the present works on the subject are adequate. Even granting that the matter presented is good—and that is a pretty liberal grant—the plans of all the works on dental therapeutics that I now call to mind are open to severe criticism. Clifford's book consists of questions and answers—an abominable method for any kind of work. Gorgas' Dental Medicine is so ingeniously disarranged that I defy any casual user to find any particular information without referring to the index. In all of the others the desired information is scattered through several hundred pages of text pertaining to pathology, or operative dentistry, and is unavailable without much trouble and time being spent in the endeavor. An up-to-date text-book, with the first part devoted to general considerations, the second part to drugs, arranged alphabetically by their common names, and the third part to brief treatises on the treatment of various diseases after the manner of Hare's Therapeutics, would be a boon to both students and practitioners.

I would treat of drugs as follows: Head the drug, for instance, aconite. Then the first paragraph would read "aconite (aconitum, U. S. P.) is the tuberous root of the aconitum napellus, a plant indigenous," etc. Only a few lines need be devoted to the derivation and methods of preparation of the drug. Then would come the "physiological action," followed by the "therapeutics," and, lastly, would come the "administration," unless the drug was capable of producing untoward effects, in which case that would come last. Under "administration" the various preparations, official and nonofficial, with their dosage, would appear. All fad therapeutics should be eliminated and there should not be a superfluous word in the book from cover to cover. Such a work is much needed.

The essayist's attitude in regard to the amount of the work to be presented can only be criticised on the score that it does not go far enough. It is my theory that the scientific branches, including anatomy, physiology, chemistry, materia medica and therapeutics, histology, bacteriology and pathology, should be taught in a dental college fully as completely as in the best medical colleges, with additional time devoted to their application to the science and art of dentistry. General materia medica and therapeutics, then, should be taught with the same thoroughness in the dental college as it is in the medical college, and its special application to the practice of dentistry should be elaborated. I am not one of those, however, that believe the dentist is competent to treat systemic disorders, nor do I believe it is his province to do so. Such assertions are the result of misinformation. The better knowledge one obtains of the practice of medicine the more unreasonable those statements appear. The general practice of medicine is rapidly separating into the practice of specialties. Educated physicians appreciate the impossibility of any one person having a sufficiently comprehensive knowledge of the human body in health and disease, to give the best results in the treatment of all ailments. In our larger cities the general practitioner is rapidly becoming limited to the various diseases of which fever is the most prominent symptom, and to lung lesions, and the tendency is to specialize in these. If this is true of the men who devote all of their time to the practice of medicine, it is folly to assert that the practitioner of dentistry, whose opportunities to prescribe systemic treatment are so rare, should feel called upon to prescribe for constitutional disorders except in the most obvious and trivial matters. I do not mean that the dentist should not feel free to prescribe a dose of magnesium sulphate or phenacetin, if it is indicated, but I do mean that if the condition of the mouth indicates gastric or enteric disorders the dentist should promptly direct the patient to one who is better qualified by continual contact with these disorders to conduct the case intelligently and successfully. The study of these subjects by the dental student is simply to enlarge his information, round out his education, and enable him to recognize the necessity for treatment. The otologist and oculist study obstetrics, but in a case of labor, they would be as much at sea as any dento-medical graduate. A more important point than even a good text-book is a good teacher. Dr. Peck has advanced to a position as a teacher of these subjects that few of our men attain. Our dental college teachers should be men who devote all, or practically all, of their time to college work. The hour spent before the class does not begin to measure the extent of the teacher's labors. To properly prepare for each hour in the class room requires several hours of outside work. If this institution can teach the teachers how to teach it will have done a great work.

The value of object teaching in the class room, and of laboratory work, cannot be overestimated. At our meeting in Philadelphia last year we discussed the value of the recitation system quite exhaustively. In those subjects for which there are standard text-books the recitation system is of great value. As I stated at that time, the fundamental subjects of anatomy, physiology and chemistry may be well taught by the recitation system, but I personally could not recommend any existing work on operative dentistry to be used in the manner that Gray or Morris' Anatomy, or Kirke's Physiology may be used. I do not see how Dr. Peck can use the recitation system in his teaching. He tells us himself that none of the existing text-books are fit to use.

I am pleased to have Dr. Peck report that his method of having one student prepare a paper, and others discuss it, was a success. Had he asked my opinion regarding such a method I would have predicted a failure. It is worthy of a trial.

DR. J. D. PATTERSON: Mr. President, the hour is late, and I know you all want to go. I had written out a few remarks to make, and I was going to say many things I shall not now, because Dr. Truman covered nearly all the points, and I agree with him in his criticism; so I shall occupy a very short time. It seems to me unfortunate that this subject is discussed here from a medico-dental standpoint (Dr. Peck is a graduate in medicine), instead of from the standpoint of a doctor of dental surgery, and on that account he merges into a line of argument which I do not think, in our present condition, is so very valuable to us. I will pass very briefly the points I want to speak about. In regard to the D. D. S. writing prescriptions, it is against the law in many states for any one who has not an M. D. degree to write prescriptions. Lawyers who have had experience in jurisprudence say that there is no question, should the point arise on suit for malpractice and damages, that it would be decided that the dentist has no right to write prescriptions for the internal administration of drugs. The board of health will not give you a license to practice medicine in the state of Missouri, where I reside, with the degree of D. D. S. You have no right, then, to write prescriptions for the internal administration of drugs. I myself have studied materia medica and therapeutics in the medical class, along with the medical students, and I believe that this broad knowledge should be our possession, yet I most emphatically disagree when it is recommended that the doctor of dental surgery shall prescribe for the internal administration of drugs. We should religiously keep away from that. It arouses so much antagonism, in the first place, with the medical profession, that we should on that account only let it severely alone. There comes to my office a person who needs a treatment internally for a condition of which I see symptoms in the mouth. They go at once to their physician, with my instructions as to what I think is required. I will not give a prescription for a simple case in therapeutics even. It is the physician's business to attend to it—let him attend to it, it is not ours. If you are an M. D., you have a right, under the law, but even an M. D., when he is practicing exclusively in dentistry, should not give prescriptions for the administration of drugs. Turn that over to your physician. It seems to me that is pre-eminently the proper thing to do.

"What would you think," Dr. Peck says, "of a man enjoying a lucrative practice in a large city like Chicago, or elsewhere, merely giving local remedies in a case of syphilis?" Does he mean a dentist? He must be talking of practicing medicine. If a dentist prescribed administration of the medicine himself, he would be doing the most improper thing he could do, in my opinion.

The doctor speaks of the necessity, especially in the field of anæsthetics, in being able to determine from the pulse the condition of the heart. I beg to say that the condition of the heart as noted in the pulse throb is not in any way a reliable indication; and when there are serious lesions of the heart, there must be auscultation and percussion; there must be markings of special instruments. The pulse alone is a very insufficient and inferior indication. In order to be able to do that a course of clinical medicine is absolutely necessary. We have not the time for that.

In the administration of anæsthetics the physician should always be present. Never do I administer an anæsthetic without the presence of a physician. While I know what remedies to use, and I know, perhaps, as well as some physicians that come in my office, yet that matter is a thing that we must leave in their hands. There must be, as Dr. Truman says, a firm dividing line between medicine and dentistry, and we must obey that very closely—that's my opinion.

I want to add my word to what Dr. Truman and one other speaker, in discussing, said in regard to vivisection. Vivisection, in our day and generation, should, in my opinion, be confined to the laboratories—biological laboratories, especially instituted for experimental purposes. Vivisection, in our day, I believe, is legitimately confined to finding out the results in the prosecution of a knowledge of serum therapy. That is being done every day, being done to-night, in the biological laboratories. Vivisection, it seems to me, should be confined there. The very experiment which Dr. Peck speaks about, anæsthetizing the animal so that it should suffer no pain, would be very imperfect. Let vivisection alone! Let vivisection alone in dental colleges. And do not introduce it, I beg of you, unless you want your dental colleges mobbed. These experiments that he spoke about, and all the experiments that the dental student would need to instruct him, to make an object lesson, have again and again been described to us. If the dental student should not have common sense enough to understand, when he reads the perfect description of the demonstration, then he has no business in our classes. If knowledge must be forced into him through stabbing an innocent animal, then I don't want him as a student. Why repeat such experiments. I say no, no, not at all. I am proud of the dental profession, but I confess I would not be proud of the dental profession which had in it vivisectors for the purpose of object lessons merely.

I thank you very kindly, and, in making any remarks that I have made, Mr. Chairman, I do not mean to reflect on anybody. You are all my friends. You know I am in earnest in what I say. I may make mistakes. You know the old story of the man who always traveled straight and never made mistakes became soon so lonely that he passed away. So I make mistakes, and perhaps you do. But I do think Dr. Peck, in advising the teaching of students who are to receive the degree of D. D. S. to prescribe internal remedies, has made a glaring mistake, and also in advising the object lesson by vivisection.

DR. G. V. BLACK: I would like to say a few words just along some of these lines, and as a preface I may say that we are here to disagree, and to discuss our disagreements. I want to reinforce some statements that have been made with regard to this matter of vivisection, and perhaps with regard to the matter of prescribing drugs, and some other things.

We all value the lives of animals. We value the lives of men more. We value the health of men more than we value the lives of animals. Now I appreciate the motive of avoiding pain to animals. I appreciate the motive of avoiding the destruction of animals, I think, as sharply as any one here; yet, if I can, by destroying a comparatively useless animal's life, impress a lesson upon my class, I should say sacrifice that animal. I am not afraid that the dental school will be mobbed. I would not ruthlessly and without the impressment of a lesson, sacrifice an animal; but in teaching anæsthesia I would not hesitate to sacrifice an animal, and I should not feel that I had properly impressed the lesson of the dangers of anæsthesia upon my class if I had not destroyed the life of more than one animal before that class with anæsthetics.

A MEMBER: That is not vivisection.

DR. BLACK: That is practically vivisection. That is what you mean—we use it for our purpose and destroy the life of that animal. That is vivisection, no matter what else we do. We may do various other things with the animal. If I take a frog and expose its lungs and show the peculiarities of the circulation of blood in the lungs for the purpose of impressing the lesson on my class, have I done a wrong thing? Certainly not. We even go so far as to use the human subject for a similar purpose, with an effect that is good. Only a short time ago one of our pupils came to me and showed his arm and said: "Doctor, I think there was a mistake in putting this drug on my arm. It hasn't had the effect that it has had on the arms of the other boys,"—for a number had applied the same drug, and a number had applied another drug and another drug. They were from Dr. Peck's class. "Cassia has been applied here and I have no blister." He had evidently been afraid that he would have a very sore arm, and had taken it off and looked at it, and had finally taken it off before the time prescribed. I said, "Let me see it to-morrow." On the morrow he had a crop of cassia pustules, and he was showing it to the others, and the others were showing theirs, and they were in groups, discussing the effects of the drug, and what it would do if used in this and that position. I tell you, gentlemen, you cannot impress a lesson with words in so interesting a way as it was expressed by these experiments, using the human subject. Of course, this thing must be done with great care and judgment, even upon the animals. It is taught before our classes that vivisection is a serious thing, and it must be done with care; it must be done for a purpose—we must get value received for the destruction of life. Gentlemen, I am in favor of the impressment of lessons, even by vivisection, when that is necessary, to properly enforce them.

I regret that we cannot all be graduates in medicine. Under the circumstances I know that it is impracticable. I wish we could be. We ought to be. I want to make a remark about the pulse. The man who would know the pulse, and know it well, must have practice in the examination of the pulse in health and disease. If he has had this practice, and has studied it closely, dropping the finger on the pulse of his patient will give him an indication—not sufficient to tell just what is the matter—but if there is a serious heart lesion, it will give him an indication that will put him on his guard. He will perhaps drop his ear over the chest to see what that heart lesion is, or see how serious it may be; or, perhaps, this impression that has come from the pulse will lead him in another direction. It is not a heart lesion proper, but it is something wrong with the nervous system of that patient. I would not like to go into a long operation for a patient that comes to me, if when I drop my finger upon the radial artery it presents a sharp, quick, feeble pulse, because the indications show a condition of nervous tension or something else that renders the patient unfit for the endurance of a long, serious operation. And I regret exceedingly that the conditions do not give the opportunity for teaching dental students to recognize these indications which the pulse, properly studied, would give them. It requires a bedside practice, a hospital practice, or a practice in surgery, or a practice in general medicine to enable one to recognize quickly and easily these conditions of the pulse that give warning of danger.

Then, again, our patients are often kept too long in the chair, and a condition of exhaustion of the nervous system will be reflected by the pulse. We ought to be able to note that at once and be able to wind up our operation and stop in time to save serious injury to the patient, which, I am sorry to say, is not always done. I have been guilty, myself, of keeping patients too long. I have recognized that, and have recognized the conditions following—the conditions of ill-health that were the direct result of keeping that patient down too long.

Now all of these things call upon us as practicing dentists, not as practitioners of medicine, to know as much as possible of these things, to teach as much as possible of these things in our schools, and have as many dentists as possible who may recognize these things with the touch of the finger, or recognize conditions that will cause them to call a halt and look further, for other symptoms showing the condition of patients, that they may not do injury. The prescribing of drugs does not belong to the dental practitioner, except in his own field.

Dr. N. S. Hoff, of Ann Arbor, Mich.: This subject of teaching materia medica and therapeutics is one that I am very much interested in, and, like Dr. Peck, I have found that it is sometimes rather an uninteresting subject to teach. Like every one else who has taught this subject, I have experienced the usual vicissitudes in trying to utilize the material we have in print in the way of textbooks which Dr. Peck and others before have deplored. We have plenty of resources in the way of works on general materia medica, and splendid resources in the way of general pharmacology. We have also a great deal of material on general therapeutics, but we are sadly lacking in a book which will present the subject of dental therapeutics in a systematic way, and it is therapeutics as the ultimate end which we desire to obtain in teaching materia medica. It is not simply the teaching of materia medica of itself that we desire to utilize. The subject of materia medica is a very small part of the work. I spend comparatively little time teaching the nature and doses of drugs. Formerly much time was spent in discussing the materia medica and pharmacy of drugs. We were compelled to learn the history of a drug, where it came from, what it looked like, what preparations were made from it, and what the dose was. Further than that, we got very little conception of its application therapeutically. One can readily believe this a very dry and uninteresting subject to teach in that way. I have turned the subject around and am teaching it from the other standpoint. I teach it largely from the practical or therapeutical standpoint—what we want the drugs for, etc. I do not teach pathology directly, but incidentally. I must, of course, refer to the nature of disease and the application of the remedies for its treatment. In doing so I naturally start at the interesting point—at the chair, or at the bedside, where the remedy is to be used. I experience here the usual difficulty of putting into the hands of my students a proper class book for this purpose, as you all know there is nothing in print that will meet the requirements viewed from this standpoint. I have followed the classification as set forth in Wood's therapeutics. I have experimented with all of the various text-books, beginning at first with Ingersoll's little work, at his own suggestion, then Gorgas' Materia Medica, then Potter's Text-book, then Brunton's large text-book of pharmacology, and then Wood's Therapeutics, where I found something that I could adapt to the teaching of this subject to dental students, because it not only contains all the materia medica that is essential, but also a pharmacological consideration of all the essential drugs, and a classification that can be fairly well adapted to our needs. While it is rather a heavy text-book to put into the hands of the student, it is the most satisfactory one that I know of. Of course, it contains nothing in the way of dental pharmacology, except incidentally. It contains nothing on dental therapeutics, and this I have been able to supply—not to my satisfaction, but very satisfactorily, at any rate, from our general literature, from the journals, and from other text-books in therapeutics. Within the last two years Dr. Barrett's little work on pathology and therapeutics has given me perhaps as much satisfaction as anything else. It is not a work that will supply the place of a text-book, but as a reference book, a book for suggestion, it has been valuable in my hands. Dr. Burchard's work has also been of great help to me.

While it is more a work on pathology, everything in it is so well done, the book is so beautifully written, that I have had a great deal of pleasure and satisfaction in using it. With these books, and with reference to classic articles on therapeutics and dental pharmacology which have appeared from time to time in the dental journals, I have been able to secure a course of lectures for class work that has proven tolerably satisfactory. Last year I presented to my class a course of seventy-five lectures. I did very little quizzing, but devoted the entire hour to the lecture, holding written examinations periodically, to see where the students were, because I did not have the time for the quizzing. I had a shorthand report made of the lectures, and this report was printed and put into book form. All who have had any experience in having lectures reported will know that anything done so hastily will necessarily be faulty and incomplete, and contain so many erroneous statements as to make it rather hazardous to attempt to utilize it as a text-book. But this was sufficiently accurate so that this year I am using it as a class book. I have had a sufficient number of copies reprinted by typewriters' stencil, and require each student to have a copy of it.

I am not lecturing this year at all, but am quizzing entirely. I spend the entire hour quizzing. At the beginning of the hour my students are seated in the lecture room. We have a seat or a bench, such as is used in the public schools—a desk with a top to it—two students can be seated at each desk. The desks are numbered, so that there is an odd and an even number in each seat. At the beginning of the hour I put two questions on the blackboard, one numbered 1 and the other numbered 2. Odd numbers will write on question 1, and even numbers on question 2. These questions are very brief, something they can answer on a little slip of paper not more than four by six inches. I allow from fifteen to twenty minutes to answer these questions. Sometimes they do not get through in twenty minutes. When requiring a little more writing or more thinking I extend the time to possibly a half hour. The men have no chance to communicate with each other, as each has a different question. It is always a question made up from the lecture of the day or the day previous—that is, the lecture they should have had were I giving the lectures in regular order. After the papers are handed in I give the answer to the question myself, so that each man knows whether he has answered the question properly or not, or I call up some one and develop the proper answer by a quiz. Or I call up a student and read some one of the answers and have it criticised. Sometimes I read one of the answers and call for voluntary criticisms. I never read all of the papers, and do not mark them. There are so many of them it would be a great task to attempt to read them, but I have in my private room a lot of nails driven into a board on the wall. I make it obligatory for each student to distinctly number and put his name on each paper before handing it in. I have a nail for each man's name, and I stab his paper on the nail for future reference. I shall read some of them some time, and I do read more or less of them. I pick out the man of whom I am a little suspicious that he is not doing his work properly and read his papers, and if his papers are not what I think they should be, I quiz him very often. The students do not know that I don't look over their papers. They do not know but that I do. By this plan every man in the room expects to be quizzed every day. Sometimes the written questions are of such a character that I do not do any quizzing during the hour, but explain the question and comment on the replies. Sometimes we spend the whole hour in a discussion of the questions. I may quiz the students or they me. Very often the quiz is directed at me. I get quizzed from all over the room. The students frequently ask questions that are quite pertinent. I am often surprised at the questions that are asked. Usually, though, I quiz the men. When I quiz a man I don't quiz him on the exact thing reported in the lecture that he has before him. I don't ask him what a dose of a drug is that we are discussing, but I say something like this: "Yesterday a patient came into my office, and he had a first lower molar tooth that had such and such a condition—and it is a condition that the remedy we have under discussion is applicable to"—I say, "What shall I do for that patient?" By asking a question something like that—I do not always put it in just that way,—frequently I do—he will start to tell me what to do. Very often he will go back to some other lecture, he will think of something back that we have gone over already, or something that has been told him by some other instructor in the treatment of another case, or he will bring up a treatment some other teacher has given him, that I have not given him at all. I make him tell me why he gives that treatment, and I confine him to that particular case and that particular condition. Oftentimes he will not recognize the condition I have indicated. The first thing is to make him give a complete and correct diagnosis, and then I tell him to prescribe the necessary treatment. Sometimes I do not quiz but one or two men during the half hour. But if I do keep one man on the floor all that time, I have the attention of every one in the room—they are all being mentally quizzed if not orally. I get as much out of quizzing that man as if I quizzed the entire class. One should avoid giving a whole hour to one man unless the rest of the class is kept interested.

This is only an illustration of another way of teaching, as the essayist has stated, by the object method. It brings up the actual object which students are dealing with every day, and makes such an impression on them that they say, "I had a case like that once and I want to know about it." I try to make the subject so practical that they become at once interested in the subject. I have never had so interesting exercises in my classes before—interesting to me. I get enthusiastic about it and the students do, too. They come to me after the hour is over and want further information about the case we have considered. They have had cases like it, or have seen them. Sometimes they want information on other cases not pertinent. I have to refer these until they come up under their proper classification. It requires a good deal of wit and wisdom to know which question to answer and which to allow them to answer. I have found this one of the most interesting methods I have ever adopted in teaching, and I think it is going to be one of the greatest value to my students. I do not know that I shall continue it longer than this year, as my text-book may wear out on me. To carry on this kind of class work a proper text-book is essential. The students must have something to study beforehand, so that they will come into the class room with some preparation. I have found this method of teaching this subject not only one of the greatest interest to me, but it has been of value to me, and I am very sure will be helpful and valuable to my students. If any of you become weary of your methods and can put into practice this method, I hope you will become interested in it. I think it will take a great deal of the tedium out of your work, and make it more interesting not only to yourself, but to your students as well. It permits them to present the subject from their own standpoint—the standpoint from which they are thinking about it. And, best of all, it enables the teacher to accurately find out where the student is and what he knows and wants to know. An immense advantage.

DR. T. W. BROPHY: I was very glad to be present yesterday and hear the paper of Dr. Peck, and I cannot say too much in commendation of it. The teachings of the paper, it seems to me, are sound.

Some of the remarks that were made in discussing it surprised me a little. In fact, they surprised me not a little. I wondered, while some of the gentlemen were speaking, what are the objects of certain chairs of our schools? For instance, why do we have a teacher who engages so much of the time of the students in presenting the subject of materia medica and therapeutics, if it is not for the purpose of qualifying these men to make use of the remedies and the methods of procedure that he advocates? If it be true that the dentist should not prescribe remedies, if it be true that he should not make use of the drugs that he is taught to use, and use them in the way that his professor explains, then such a chair should be abolished, because it is not fair to take up the time of young men sitting in the benches and paying their fees for instruction, in teaching them certain departments of science which they, through the law, as was said, cannot employ after they graduate. I hold that every chair, that every department taught in a dental college, is taught in good faith on the part of the teacher and of the institution, and that the student who expects to receive this instruction is qualified to use it after he gets it, and, I repeat, if he cannot, by restriction of the laws of a state, or of the nation in which he lives, use what he has learned, then the chair should be abolished. I hold that a man who receives instruction in the administration of remedies or in the performance of surgical operations or anything else in any of our dental colleges, has the right to make use of it, and if he makes mistakes he is amenable to the laws of the state for malpractice. It is not a question of possessing the degree of M. D. at all, that has nothing whatever to do with it. In England the surgeons have not those degrees in all cases. They have their qualifications, however, as surgeons. They practice surgery; they do it under the laws, and if they make mistakes they are punished according to the laws. The laws of our states have chartered our institutions to go on and teach certain branches, and if they teach those branches the laws of the state will protect the man who goes out to make use of his knowledge. There is a mistaken idea, it seems to me, of what the degree of doctor of medicine empowers a man to do who possesses it.

A MEMBER: You mean doctor of dentistry.

Dr. Brophy: I meant exactly what I said. The degree of doctor of medicine, what does it empower a man to do? Would any one assume for one moment—I would perhaps better relate a little experience I had in Philadelphia a few days ago when Dr. Kirk was discussing with me this very question. He said one of the most distinguished members of the medical faculty told him, about eight or ten years ago, that the degree of doctor of dental surgery was an evidence of a partial culture only, or a partial education, being so—I will use the expression—being so short-sighted as to believe that the degree of M. D. meant a full culture. Now I do not think there is any man who has a thorough knowledge of what the course of instruction in medicine really is who would state that a man who bears the degree of M. D. is qualified to take up and intelligently practice all of the departments of medicine. Is it not true that the man who devotes himself to the treatment of the eye and the ear naturally feels that his knowledge of cutaneous diseases is not very sound? Would he, then, presume to treat cutaneous diseases on a par with a man who devotes himself specially to that branch of medicine? No, sir! He would do exactly as we do—and in this I agree with Dr. Patterson—he would put his patient in the hands of a man having under treatment from day to day those suffering from the kind of malady affecting his patient. For instance, if a man were suffering with a specific disease—syphilis, for instance—we might treat him and treat him perhaps as well as could be; but we do not need to do that. Nor do we need to take up and attempt to practice gynecology; we would place our patients in the hands of some one devoting himself to the treatment of that class of disease.

The curriculum of our dental schools has broadened, and is yet broadening and including other branches of learning. We are qualified to prescribe remedies. We must not be told that we have no right to administer anæsthetics. Who is to say that the profession that brought to humanity that great boon, anæsthesia, should not have the right to use it? Practically, if they were to do that, they would deprive us of our birthright. We have a right to use it, but we must know, if we use it, how to use it, and under what conditions to use it. We must know how to make a diagnosis of any malady that may confront us. The man who would make use of ether in his practice without a knowledge of, for instance, albuminuria, or any of the renal diseases, would be groping in the dark. A man who would do that might be punished according to law for not observing the precautions that are necessary in the interest of his patient. The man who would administer chloroform to one that has a weak heart, who has an intermitting pulse, or who has at times syncope coming on without any cause apparently —any external cause—or a cause due to an internal disease, would be doing wrong. Consequently, we open up here a new field, we open up a branch we are called to add to the curriculum the chair of physical diagnosis; and the time is now come when the department of physical diagnosis must be a part of the dental curriculum; and I do not think the time will be long until we will see every dental college in the country giving careful instruction in the physical signs of disease.

These are thoughts that came to me during the discussion last evening. The discussion was merely a medley of opinions, and while we look upon our work and think of it, and think of how little we are doing now compared with what we are yet to do—those who are to follow us are to do, and when we think of how we have gathered up as much as we have, we look back, and are very proud of our achievements; and yet, when we sit down and reason the matter out carefully, we cannot help but feel that we are doing very little indeed compared with what is to be done.

I cannot agree with one of the speakers of last evening who stated that we should not administer remedies. What is there that is used in medicine that calls for better judgment than the use of anæsthetics? When a patient goes into a collapse during an anæsthetic, the dentist thinks, "Why, I have no right to administer remedies; what am I to do?" If he cannot administer remedies, he must lose his patients, probably. He *must* use remedies, he *must* know how to use them, and to use them with the highest degree of intelligence and according to the best methods.

That is all I have to say. I want to congratulate the association on this paper. Like all the papers of the author, it was a good one, and I hope he will keep it up and stick right to that line of work, so that the schools all over this country will engage in that careful teaching of therapeutics that he has outlined. I hope they will soon come to it, and when they do, our profession will rise in the estimation of all.

I want to say one more word. I know I am talking too long. I am talking mighty near as long as Dr. Hoff did. When I arose

I didn't mean to. I had the good fortune to be present in Paris at that great congress. There has never been anything said about that in this meeting. I don't know as I will have another chance to speak about it. I want to say to those of you who were not there that that was the greatest meeting of dentists that the world has ever known. There was more work done there at that meeting for the advancement of the dental profession than was ever done before in any meeting, but as the papers come out now, as you see them in the *Dental Cosmos*, if you read them you will find that there were dentists who were advancing ideas which will revolutionize the practice of medicine. Read, if you please, a paper of Dr. Michael's, of Paris, on the examination of the saliva. He has accomplished so much from a dental standpoint, and has shown to the satisfaction of those who have been close to him that by careful examinations of the saliva we are able to make a diagnosis of almost any form of disease known, particularly those affecting the general system. The examinations that he has made have convinced those who are familiar with them that the methods that he employs are far superior to those examinations of the urine, as has been done heretofore. And by these examinations he is able to detect maladies of the different tissues of the body that is most marvelous. Then the other papers invite your attention. These papers are coming out now in the *Dental Cosmos*, and those of you who have not yet read them will be surprised to see the work that was done in that congress. I hardly know how many years it will take through the *Cosmos* to give them all. But it was a great meeting, and when we have the next one we will have one still greater, I have no doubt.

Dr. G. V. Black: I want to say a word that Dr. Brophy failed to say. First, I want to call your attention to the work of Dr. Michael in Paris, that you may watch the progress of thought in that direction, because it is the direction of thought that must necessarily, as I take it, become prominent in dentistry within a very few years. With regard to this matter of the examination of the saliva, not only to diagnose general diseases, but it points directly to the conditions—the physicial conditions—of the cellular elements and juices of the body which bring about caries and which bring about immunity from caries of the teeth; and it was this particular point that induced Dr. Michael to go into this study, and his study of the other diseases in connection with this was simply incidental to the study of the conditions in which caries of the teeth occurs and in which immunity to caries of the teeth occurs. He has entered the wedge in the study of the cellular elements and juices of the body with reference to this subject. It will necessarily become prominent within a very few years. We will have to wait, possibly, a number of years for the perfection of this class of study along other lines before we can make it effective in our specialty; but the time is coming, and those who do not follow this, and follow it carefully, will in a few years undoubtedly find themselves behind the times.

DR. BROWN: May I take the liberty again of trying to keep this discussion together? It seems to me that we are talking of two different subjects under one head. I am satisfied that no one here wishes to authorize the dentist to prescribe for general diseases, such as typhoid fever, scarlet fever and various other affections of that kind. Possibly that was what was meant by the gentleman who objected to the dentist giving prescriptions. On the other hand, while the discussion seems to be extreme, I am satisfied no one here can rightfully object to the dentist having the same privilege that the oculist and the aurist and the other specialists have, of giving such remedies as will help the particular cure that he is trying to effect, in his own special field, and without such remedies it seems to me no one can hope to succeed. An inflammation is inflammation, barring certain differences of the tissue, their vessels and nerves, and so on, but practically the principles of inflammation are the same, and I think the remedies that Dr. Peck called attention to, particularly with reference to dentistry and the teaching of dentists, which he desired to emphasize, if I understand his idea, were such as were necessary to be used in almost every inflammation of a serious nature that we have to deal with in dentistry; and it seems to me if we can bring this thing to a point where we can all agree—and I am sure we can, that we will then have accomplished something valuable in this direction.

DR. F. B. NOYES, of Chicago, Ill.: I am tempted to branch off on certain things which, as I take it, do not strictly belong to this institute—mainly the position of dentistry as a profession, and some things in connection with topics presented in the paper: the use of animals as teaching agents. The discussion of the position of dentistry as a profession does not strictly belong to this institution, and the discussion of vivisection as a method does not strictly belong to this institution; but we are concerned with teaching methods, and, in connection with the discussion of this paper, with teaching methods in the presentation of materia medica and therapeutics. Now as such I wish to speak for just a moment in regard to vivisection. I do not want to call it vivisection, because there are horrible suggestions and fantasies created by that word. There is in the minds of men and women over the country, connected with the word vivisection, the idea of strapping an animal down to a board, muzzling him with gags, and cutting him to pieces while he is alive and sensate. Now, gentlemen, no one here will advocate that method in teaching our profession or any other. It may possibly rarely be used for investigation work. It may possibly be justified, in rare cases, but nothing of the kind is suggested in the paper. On the other hand, how are we to know the mechanism of the human body unless we study it? Would any one advocate that an engineer is not to study the machine which he has to run, that he is not to see that machine in operation? And if we are to treat the human mechanism—the vital mechanism—infinitely more complicated and inter-related, are we not to study that machine as it stands still and as it works? Am I not, in the preparation of my material for histological work, to kill animals, to remove their organs while the life is still in the organs? The animal feels nothing; the animal knows nothing more—it is as an animal dead, but its tissues are still alive, and I want those tissues while they are alive, to study. Again, in regard to the phenomena of life: how are we to study the phenomena of circulation and respiration, and the phenomena that involve mechanisms unless we watch those mechanisms? The value of that object teaching I want to emphasize. We may describe the phenomena of respiration and the effect of it—you may show that in models—a thing that has not been suggested, perhaps, by constructing rubber models, for circulation—but in no way can we produce the impression upon the mind of the student as he will receive it while watching the thing itself. Again, I want to repeat, we may teach him all about respiration, but he does not know what it means until he studies it himself—until he observes it himself. He does not properly appreciate it. The demonstration to a whole class, which may be in a certain sense imperfect—the value of the laboratory method, which has been suggested by the doctor, following out, repeating individually what he has seen, is of more value still, but I want to emphasize, especially as a teaching method, the object teaching—the observation of the actual thing.

Dr. A. H. Peck: Mr. President, I am delighted with the reception accorded my paper by the members of this institute. Had every one who spoke upon the subject had nothing but words of commendation I should certainly have felt that my mission here had been a failure, for if there is anything that I do dislike to hear in these meetings, it is nothing but words of praise and commendation for the essayist and the essay.

I was not disappointed when the remarks of Dr. Truman were read in this discussion, for I had talked with him not many months ago on these very subjects, and knew his sentiments in regard to these matters. I expected exactly the discussion from his pen that we listened to. I was somewhat surprised, however, with the extent of the vigor more than anything else, thrown into the remarks of Dr. Patterson. However, I know that Dr. Truman and Dr. Patterson are absolutely sincere in their beliefs in this connection, also in what they do and say, and in that respect they draw out from me nothing but admiration—for I love to see a man of convictions, and a man of sufficient courage to state his convictions. However, I disagree—I cannot help but disagree with the sentiments of these two gentlemen, and with all due respect to them, as one of the last speakers this morning has hinted, this idea of vivisection with any other name, would not appear half so bad as it does when that word is used. I purposely avoided the use of that term, so as to make this work, or this particular part of the demonstrative work in my department, as mild to your sensitive natures as possible. I would not advocate the reckless use of animals in teaching in this department or any other. I would not for anything carry this particular work to such an extent as to imbue the members of the class with a reckless desire, if you please, to appropriate animals to their uses in this particular, and abuse the use of them. I want to say this, that much of the most valuable knowledge I possess in this connection I have gotten through these means, and I believe there is no other method by which we, who are teaching these subjects as I try to teach them, can employ with equal effectiveness to impart knowledge to the members of our classes. I would like to ask those who shrink from the use of an animal for these purposes in the manner which I have advocated, if they found themselves out on the plains, far removed from any settlement and were hungry, would they shrink from the appropriation of an animal to satisfy their hunger? By no means. We all like a nice roast rabbit, or a nice juicy piece of beefsteak when we are hungry. There is a parallelism in the comparison which I shall make, although it may seem to some there is not. Our dental students are before us in the lecture room; they have paid their money and they are giving their time; they are hungering after knowledge; they are entitled to the best we can impart to them. It is our duty as teachers to employ all legitimate means at our command to furnish, in the most impressive way, that knowledge for which they are hungering. If I can best impart it by the proper use of an animal, I shall continue to do so. My conscience shall remain untroubled.

I did not intend to advocate that dentists should be expected to prescribe for all systemic disorders that in any way have a bearing on oral diseases or manifestations. I would not attempt to do that myself. However, in regard to the remark that Dr. Hunt made in this connection, that when he went out of the opera house with his medical diploma in his hand he felt that he was just as capable of entering into this field of work as was any other member of the class, I wish to state, and I state it honestly, that when I walked out of the opera house with my medical diploma, for which I had labored hard, I felt that I had only just gotten a start, that only the foundation was laid. I have tried, by hard work, through the years that have passed since that event to supplement the start which I then had, and I feel to-day that I am in a position much better able to prescribe for these general diseases than I was at that time. Of course, Dr. Hunt no doubt meant what he said as a joke, but I am glad to use it as an illustration, to drive home to you the manner in which we should take hold of these things, and in which we should endeavor always to prosecute them. The thought which I wish to impress you with is this: That the dentist in treating the local lesions of syphilis, e. g., as manifested in the oral cavity, who is unable to recognize the necessity of systemic treatment, and I know there are many like this, that dentist, in my estimation, is a failure in the practice of his profession.

Dr. G. E. Hunt: I don't know whether you believe in the rheumatic diathesis as a cause for pyorrhoea, but if you do, and a patient presents himself to you, do you give the constitutional treatment yourself?

Dr. Peck: If that is intended personally, I will say that I would treat the general conditions myself, and I am treating a number of just such cases at the present time. I would not impress you with the idea that I would expect every practitioner to do these things, but I want every prospective practitioner of dentistry instructed before he leaves the college, so that he will at least be able to recognize the necessity of proper attention being given to the systemic disorders that are constantly aggravating the local manifestations in the mouth. If we can go a step farther, and impart to them the necessary qualifications that they may be able to properly prescribe for such systemic diseases, I say so much the better; and I stand ready to hail the day when dentists shall have this knowledge.

Some one, during the discussion, has said the pulse is not at all times an accurate index of the various lesions to which the heart is subject. Well, who says it is? I will say this, that he who is familiar with the diseases to which the heart is subject, and with the various methods of diagnosis, will find the pulse a much more accurate index to some of the lesions than he who does not possess this knowledge has ever dreamed of. It is my judgment that our students should be well drilled in this line of thought.

THE USE OF THE LANTERN IN TEACHING DENTAL HISTOLOGY IN ITS RELATIONS TO OPERATIVE DENTISTRY*.

By F. B. Noyes, D. D. S., Chicago, Ill.

The discussion of this subject requires at least a brief consideration of the position and importance of histology in the dental curriculum, and the methods of teaching it. The importance of the subject in the curriculum depends upon the attitude taken toward the practice of dentistry. If dentistry is regarded as a mechanical trade, consisting in filling carious cavities in teeth and replacing lost organs by artificial substitutes, histology is likely to be regarded as having a very small place in its curriculum; but if dentistry is a profession whose field is the treatment of the diseases of the human mouth, especially caries of the teeth and the maintenance of a useful armature for the mastication of food, histology must be considered one of the very foundation stones of its professional knowledge.

With the development of modern biology all of the problems of physiology have been restated in terms of cell physiology; and all pathology reduced to cell pathology. The knowledge of cell structure must then, with the dentist as with the physician, be the rational basis of treatment of all diseased conditions of the tissues. Not only is this true but in mechanical operations upon the teeth their permanence and success, as well as the rapidity of their execution, depend very largely upon a minute knowledge of tooth structure. It is not necessary to insist further upon the importance of the subject to the practitioner as an individual or the profession as a whole.

It is a principle in biology, now generally accepted, that the individual in its development from a single cell repeats the evolution of the type from the simplest forms, or ontogeny repeats phylogeny; although in the higher forms the development which required ages for the type is crowded into a few months or weeks for the individual. Similarly it is a law of the psychologist and pedagogist that the mind of the individual in its development repeats the development of human thought; only what required ages or centuries to be mastered in the first instance may be passed over in a few months or years. In this sense knowledge cannot be handed down, but the road to it may be shortened.

A man's work cannot be handed down as something finished and complete. In order for it to be understood, enough of his work must be repeated to have his thought become fully intelligible to succeeding thought. But what one man worked perhaps a lifetime to establish, may be demonstrable in a week. All of the blind trails, all of the fruitless labors, all of the slowly corrected fallacies are eliminated and his work may be repeated and his statements understood with the same meaning in a very short time.

His statements alone cannot be handed down as knowledge, for unless the individual mind passes over the things which first lead to those statements they cannot be appreciated or understood. In other words, they do not become the working property of the mind until the individual has developed them for himself, though the road once traveled may be rapidly traversed by those following.

Some of the gravest fallacies of human thought have arisen by this lack of true knowledge. Statements being taken empirically and made *a priori* basis for deductions where the meanings of the premises are really entirely changed or misunderstood. Examples of this may be seen again and again in dental literature.

Histology, literally the science of the tissues, is the study of the structural elements of the organism and their arrangement to form the tissues and organs of the body. It is one of the younger of medical sciences, but has come to be one of the most fundamental in modern thought. In the development of medical thought it was lead up to from two directions. The anatomists arrived at the very threshold of modern histology from the analytical study of the body and its organs, and here they were obliged to wait for the development of the microscope to show to the senses what they had already logically proved must exist. The biologists and pathologists, the students of life and disease, were led to the cell theory, especially in the study of the causes of disease, but they too were obliged to wait for the development of the microscope. It is true, however, that the development of the knowledge of the cell and cell life was made by the biologists first and later carried on by the anatomists. Single cells were known and studied before the tissues were thought of as made up of aggregations of such cells.

But while the development of thought has been from the single cell to aggregations of cells, the study of single cells was preceded by the morphological study of many higher forms of life, their vital functions and the analytical study of the structure of their bodies.

Histology then should be preceded in the course of individual development by the study of living forms; for instance, botany, beginning with the observation of the forms of leaves and stems and flowers; then the analysis and classification of flowers, using a simple microscope or hand magnifier in dissecting and observing the parts. In this way through smaller and smaller forms to the single celled plants and animals of pond and ditch life. The student is first led to observe the forms and structure of living things, the vital properties which distinguish them from inorganic matter, to analyze their structural parts, noting similarities and differences, and by studying smaller and smaller forms of more and more simple structure till the simplest forms of single cells are reached. This is the path which human thought has followed in the development of human knowledge. Then an ascending study begins, taking up the structure of higher forms in terms of their structural elements or cells.

There is perhaps no teacher in a dental school who feels the lack of sufficient preliminary training in our students so much as the professor of histology. He is obliged to jump the natural development as if we were to put a fifteenth century botanist into nineteenth century study of botany.

In view of this general lack of training there is, in my experience, no introductory work to general histology so good as the study of pond and ditch material. Here the student finds comparatively large forms and single cells which are big enough to be seen with the unaided eye. Here, too, he finds cells associated into threads, sheets and masses and so is led up to the formation of tissues.

Here he has an opportunity to study the properties which distinguish living from non-living matter, and may gain his first conception of the mechanism of life.

This as an introduction leads to the study of epithelial tissues, followed by the other elementary tissues, and the study of the relations between cells as centers of activity and their products in formed materials which constitute intercellular substances. The last part of the course, of greater or less extent, for the study of the relations of these tissues to each other in the formation of organs.

The following of such a course through one year should put the student's knowledge of physiology and the phenomena of life upon the basis of cell structure and cell activity, and prepare him for the closer and more difficult study of the tissues with which he will specially have to deal. The relations between cellular and intercellular elements in the formation of tissues belongs to general histology; that is, the distinctions and relationships between vital and physical, between the active, living protoplasmic elements and the formed materials produced by them. These formed materials are such important elements of the special dental tissues that unless these relationships have been kept in mind in the general work the student will not be in mental condition to understand and interpret his observations.

METHOD.

It would seem unnecessary to argue before this organization the advantages of the laboratory method over other methods in the study of histology.

In histology the student is studying things, minute though they are, and their relations, to form large and more easily observed things. Very few persons possess sufficient imaging power to construct a mental image from word descriptions alone or by the aid of pictures; especially is this true where all the descriptive terms are new and the standards of measurement unknown. To form a true conception of the size of the things studied, is one of the most difficult things in connection with the subject; even by the laboratory method it can only be done by the use and comparison of various powers and by making drawings as accurately as possible to scale.

By the lecture method, illustrated by lantern or chart, the student is apt to think of things in the size of the picture, or in section only. In other words, they may learn a great deal *about* the things studied, but they do not know the *things*. They learn the appearance of sections, but they do not get ideas of structures in their dimensions of space. Even photographs cannot give complete ideas of structure. As has been said, "photographs give single fields accurately, but it is with the fingers on the fine adjustment screw that we study the structure of a tissue." To one who has so studied the tissue, the photograph may be nearly as good as a view of a microscopic field; but to one who has not such study back of him, they are not capable of giving the ideas of structure. A comparison occurs to me. The moving pictures which are familiar to all are made up of a series of photographs; if seen one at a time they convey no idea of motion, but if seen in rapid succession the motion appears. So single fields give no idea of the third dimension, but by moving the focus the ideas of depth and relation are obtained.

Dental histology is doubly important to the practitioner for a knowledge of the structure of the dental tissue and the surrounding and supporting structures must be not only the rational basis of dental pathology, but the foundation of ease, rapidity and success of operating.

In view of the importance of the subject, the study of dental histology has, in my opinion, been somewhat slighted in the arrangement of dental curricula. In many cases it is not taught as a subject, but something of enamel structure is given in connection with operative technic and operative dentistry, and possibly dental pathology, and so on, in other subjects, individual teachers, giving some instruction in structure as an explanation of their teaching, instead of studying the structures consecutively and connectedly as a foundation for interpretation of dental physiology, pathology, and technic of treatment.

The course in dental histology should take up the subject where dental anatomy and general histology leave it, studying first the arrangement of the dental tissues in the formation of the teeth; then the minute structure of the calcified tissues, beginning with the dentine and cementum, following with the enamel. The hard tissues should be followed by the soft tissues, the pulp, and the surrounding and supporting tissues, gum, periosteum, and peridental membrane. This study of structures should be made in its connection to physiological, pathological and technical bearings.

The uses of the lantern might be treated under two heads: First, as a means of presenting ideas of structure in connection with word descriptions in lectures, and second, as a means of assisting the interpretation of microscopic observation in the laboratory.

STRUCTURAL ELEMENTS OF THE ENAMEL.

The physical properties of the enamel which are of importance to us in the mechanical handling of the tissue are due to the nature and arrangement of the structural elements. The enamel is not a homogeneous substance, but is made up of long, slender rods or prisms, sometimes called enamel fibers, which are five or six sided, usually pointed at the ends, and alternately expanded and contracted in their length. These rods are from 3.4 to 4.5 m. in diameter, and many of them probably extend from the dentine to the surface of the enamel.

These rods are arranged so that the expansion in one rod comes opposite to the expansions of the adjoining rods, and they are united by a cementing substance which is also composed of inorganic material. While both the rods and cementing substance are completely calcified, the two substances show marked differences, both chemical and physical. The cementing substance is more rapidly acted upon by acids and is not as strong as the substance of the rods. The substances are also of different refracting index. In splitting the tissue it separates upon the lines of the cementing substance, not at the center of the rods.

The lantern is able to well convey these ideas of structure. We may show, first, enamel rods as seen isolated by caries and as seen in transverse section, projecting photographs of drawings made to show the elements diagrammatically, and follow these by photographs of the sections from which the drawings are made. Then we may show the arrangement of the rods and their relation as seen in their longitudinal sections. The expansions and constrictions of the enamel rods and the relation of the rods to each other in the make up of the tissues cause the appearance of striation, seen in the enamel with comparatively high magnifications. These expansions also record the manner of development of the individual rods.

The conspicuous brown bands known as the lines of Ritzeus, stratifications, or incremental lines, are well shown with lower magnifications. They are due to pigment deposited with the inorganic salts and record the development of the enamel cap as a whole. They are of special interest as a record of the growth of the tooth crown and the position and direction of imperfections of structure caused by interrupted nutrition.

If the student's knowledge is obtained from lantern pictures alone, he fails to get any conception of the size of these elements and their relation to the tissue, as he will handle it in gross, use what means we may to convey ideas of magnification. If, however, he looks at a section of a tissue, places it upon the stage of a microscope and uses successively higher and higher powers until the elements can be seen, draws a few as they appear and figures out from the drawings and the magnification the size of the object and the size of the paper required to draw the entire crown at the same scale, he has gained ideas of structure hardly to be given by lantern pictures alone.

The best means which I have found for conveying ideas of size with the lantern is the use of photographs of a stage micrometer made with the same magnifying power as the photograph of the tissue, using these as a ruler on the screen. In using these it is necessary to start from some known standard, as the millimeter; using first a power low enough to show the entire scale. But this is a great tax upon the imaging power of the students. It is also of great assistance to compare structure to some known or previously studied object, such as a red corpuscle, as a standard.

The relation of the structure to the cutting and manipulating of the tissue may be beautifully shown with the lantern. The cracking and splitting in grinding showing the way the tissue cleaves under cutting instruments. In places where the rods are straight, as on the labial surface of incisors, the tissues will split easily in the direction of the rods; but where the rods are gnarled and twisted about each other it will not split if supported upon sound dentine. The slides show these two conditions, which account for much of the difference of feeling of different specimens of enamel to cutting instruments. The gnarled enamel will not cleave when resting upon sound dentine, but if the dentine is removed from under it, it will break through in an irregular manner.

In the outer part of their length the rods are usually straight and parallel, and the tissue will often cleave to that depth, the rods breaking off where they twist around each other, leaving the inner half of the enamel, which is very hard to cut. This gnarled inner portion is more easily removed by getting a small bur into the dentine and undermining it, tearing up the tissue from within outward, the structural elements being more easily separated in that way.

In cleaving the enamel, the instrument does not enter the tissue, separating rod from rod and following their direction, but the sharp edge engages with the surface, penetrating slightly, and then the force applied at an acute angle to the direction of the rods, assisted by the bevel of the instrument acting as a wedge, breaks the tissue in the lines of least resistance. If the instrument is sharp it penetrates slightly, scratching the surface, but if it is dull the edge rests across the ends of many rods and force applied to it may crumble the ends of the rods, but will not split the tissue through to the dentine.

STRUCTURAL REQUIREMENTS OF STRENGTH OF ENAMEL WALLS AND MARGINS.

From the characteristics of the tissue we find certain structural or histologic requirements for strength of enamel walls and margins:

1. The enamel must be supported upon sound dentine.
2. All enamel rods forming the wall must have their inner ends resting on sound dentine.
3. The rods forming the cavo-surface angle must be supported by short rods, whose inner ends rest upon sound dentine and whose outer ends abut on the cavity wall, where they will be covered in by the filling material, these acting as a buttress to the rods forming the margin.
4. The cavo-surface angle must be so trimmed or beveled as to protect the ends of the rods forming the margin from fracture in condensing against them.

The first step in the preparation of an enamel wall is to determine the direction of the enamel rods and at the same time obtain the outline form by cleaving the tissue with a hand instrument (Fig. 1). The inclination of the enamel wall must then be extended so as to leave the rods forming the cavo-surface angle supported by short rods covered in by filling material (Fig. 2). Where this can be done a strong wall is produced; where this cannot be done the rods forming the margin must be supported by a few protected rods, by beveling the cavo-surface angle. (Fig. 3.)

We may show with the lantern the preparation and trimmings of such enamel walls first in straight and then in curly enamel (Fig. 4).

DIRECTION OF ENAMEL RODS IN THE STRUCTURE OF THE ENAMEL CAP.

In describing the direction of enamel rods I have used three planes as standards to which to refer all angles and have used the centigrade division of the circle because our students are familiar with it from their study of instrumentation.

The planes are, a mesio-disto and a bucco-linguo-axial plane and a horizontal plane. The first two are defined as passing through the crown in the axis of the tooth from mesial to distal or from buccal to lingual, the third as at right angles to the other two. In describing angles enamel rods are always considered as extending from the dentine to the surface and the angle with the standard plane being formed at the dento-enamel junction.

From a study of longitudinal sections of the teeth it is found that in the enamel cap the rods are so arranged as to give the greatest strength to the completed structure, and this arrangement may be likened to an arch, the point of the cusp, cutting edge or marginal ridge being the crest of the arch.

Beginning at the gingival line the rods are inclined six to eight centigrades apically from the horizontal plane. Passing occlusally they reach the horizontal plane at about the junction of the middle and gingival thirds of the crown, or in the gingival half of the middle third. Passing occlusally from here they become more and more inclined toward the occlusal until in the occlusal third they may reach an angle of eighteen to twenty centigrades occlusally from the horizontal plane. Over some portions of the crest of the cusp, incisal edge, or marginal ridge they reach the axial plane, but in these positions they are often very much twisted about each other, forming the strongest possible keystone in the perfect structure. Passing down the central incline of the cusp the rods become again inclined away from the axial plane toward the central pit or groove. This plan of arrangement can be shown in the drawing which has been made from a photograph, but in the photograph the magnification is not great enough to show the rods well. In a mesio-distal section of a bicuspid the rod directions are also shown in the same way and in this section the tissue has cracked in grinding so that the checks show the rod directions.

This arrangement of the enamel rods should be studied in detail for each of the classes of teeth, as the enamel rod directions in different positions should determine the angle of enamel walls in those positions. As a general statement it may be said that a strong enamel wall is easily obtained where the rods are inclined toward the cavity, while if they are inclined away from the cavity it is often very difficult to make a sufficiently strong wall. This will be shown in the latter part of the paper.

PREPARATION OF ENAMEL WALLS.

We can take only a few typical positions and will begin with an occlusal fissure in a superior bicuspid. This bucco-lingual section (Fig. 5) shows the entire crown and the position of the groove in which caries so often occurs, usually starting at the pits. Showing just the region of the groove we see the direction of the enamel rods and character of the structure (Fig. 6). A small burr is started in at the pit and carried so as to remove the dentine from under the enamel and then open the groove from within outward; the chisel is then applied to the surface and the tissue cleaves in the direction of the rods as shown in the figure. The enamel wall must now be planed down with a sharp chisel or enamel hatchet so as to bring the plane of the enamel wall into the axial plane. Notice the structure of the enamel wall. The rod which forms the cavo-surface angle is supported by a "V" shaped piece made up of shorter rods resting on sound dentine and all supporting the rod which forms the margin, thus making the strongest kind of an enamel wall. This condition is typical of occlusal cavities and is easily obtained where the rods are inclined toward the cavity, as they usually are on the occlusal surfaces. The cavo-surface angle does not require a bevel unless it is called for because of the sharpness of the corner, and the danger of injury to it.

We may take one more occlusal cavity, a fissure in a molar where caries has occurred. The undermined enamel is removed with a chisel, noting the rod direction. It is not necessary to cut away the dentine beyond the point where sound tissue is reached and then the enamel wall would be trimmed so as to leave the buccal wall in the axial plane and the lingual wall inclined in this instance about six centigrades lingually from the axial.

Taking the mesial plate of a bicuspid and preparing a simple proximal cavity in it we have the conditions shown where the rods are inclined away from the cavity. The occlusal dentine wall cut in the horizontal plane and at the junction of the occlusal and middle thirds of the crown, the enamel wall must be inclined occlusally at least twelve centigrades from the horizontal plane to reach the enamel rod direction. This angle cannot be extended without making the edge of the filling material too thin and the enamel wall is very weak because it has no support from protected rods. The entire mass of enamel from the occlusal margin over the marginal ridge will break out easily.

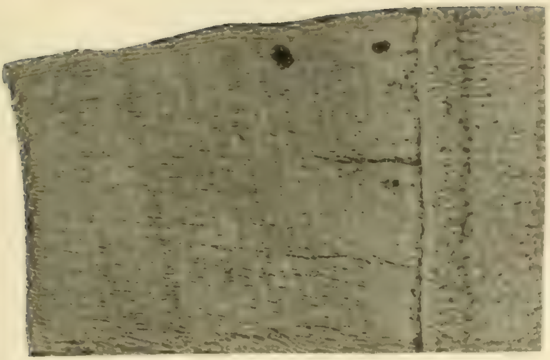
Fig. 7 shows a portion of the buccal plate of a bicuspid which is fairly typical of axial surface enamel in such positions. A portion of the enamel has broken out, showing the way an enamel wall would be cleaved by a chisel. In preparing these walls the tissue must be planed down with a very sharp hand instrument, extending the angle of the enamel wall a little, and then the cavo-surface angle beveled to strengthen the rods forming the margin, as shown.

Fig. 8 shows a buccal cavity in the superior molar, a position in which caries so often occurs. A higher power shows the region of the cavity with the enamel broken out. In the gingival wall the rods have broken across, not following their direction as accurately as usual. The occlusal wall must be extended, inclining it about ten to twelve centigrades occlusally from the horizontal and beveling the cavo-surface angle. The gingival wall inclined about six centigrades apically from the horizontal and beveled.

Finally Fig. 9 shows a lingual pit in a lateral incisor in which caries has progressed, undermining the enamel plates in both directions. This is chopped away till sound dentine is reached, then the occlusal wall inclined ten to twelve centigrades occlusally from the horizontal and the angle beveled. The gingival wall is trimmed into the horizontal plane and beveled slightly. Taking the gingival wall alone the conditions can be better shown.

STRUCTURAL DEFECTS IN RELATION TO THE LINES OF CAVITY MARGINS.

In the development of the enamel cap the tissue is not formed from a single center, but from a number of centers, and the lines at which the formations from the several centers unite produce lines of weakness in the fully formed tissue. These lines produce surface markings upon the crown, the study of which belongs to dental anatomy, but dental histology should study the structure of the tissue in these regions in order to appreciate the conditions which exist when a cavity margin is made to approach a groove



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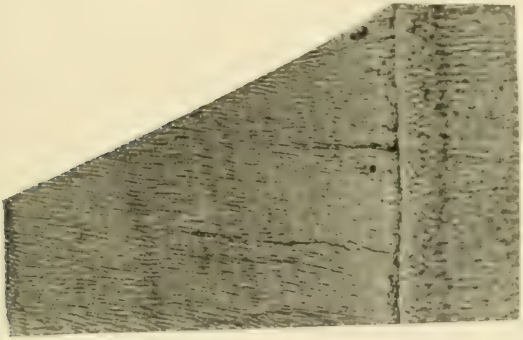

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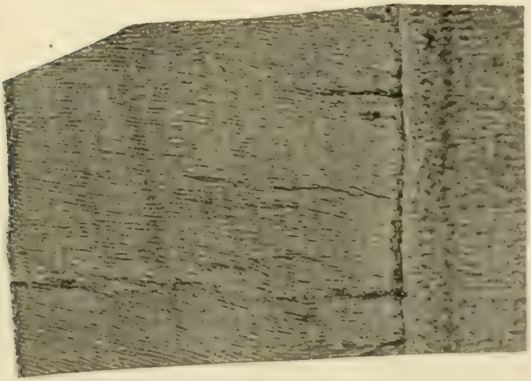

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Figures 4 to 10 appear in January DENTAL REVIEW, 1900.

or fissure which may show no signs of caries. We may show photographs of the crown which show the macroscopic appearance of the enamel defect and the photomicrographs of the sections through the defects, in this way giving some idea of the relation of the two.

Fig. 10 shows a section through a groove. If a cavity wall is left at the position of the line a the rods are inclined away from the cavity, a strong margin cannot be made and a point of liability is left very close to the margin; if, however, the cavity is extended to the line b a strong wall is produced and the point of vulnerability removed.

DISCUSSION.

DR. H. T. SMITH: Mr. President and gentlemen: I hardly know what to say to you about this excellent paper. I had the privilege of reading it coming down on the train, but it has been so elaborated by the impromptu remarks and the excellent pictures, and it covers so vast a field I do not know what to say.

We have had in operation in the Ohio College for a number of years a Colt lantern, such as the doctor is using, and have found it a very useful teaching method. I personally am not a teacher of histology and I should, for that reason, not go into the histological part of the paper at all. But I do know something of the technic of lantern work, and the preparation of slides, having worked at that sort of thing in our own laboratory, and I hoped that the doctor would bring out, in a short way, the technic of the preparation of these slides.

I shall confine what few remarks I have to the position and placing of the lantern, and its use, in a technical way. Our own lantern is placed in a lecture room which is not brilliantly lighted. A screen is located in a comparatively dark corner and the lantern is in position at the lecturer's stand at all times. The pictures are projected on the screen without darkening the room in the least, and the control of the class is not lost in any way. To all of you who have used the lantern, these points would arise as being advantageous to the proper control of the class.

The lantern, I think, is useful just in proportion as it can be used conveniently and quickly by the lecturer at his rostrum. If he is to make a pictorial display of his lecture, he weakens his lecture just that much. If it is to supplement his lecture, if he can supplement his word pictures with pictures on the screen, I think it is the very greatest aid. I have been a believer, personally, in diagrammatic illustrations.

I remember particularly in my student days a professor who was ambidextrous at the blackboard with his chalk, and the impressions we got from the pictures he drew, with colored chalk, were very pleasing indeed; but this lantern work, while it is of the very greatest assistance to the student, does not help the lecturer in becoming a trained illustrator.

I concede, and I think you all will, the importance of dental histology in the dental curriculum, as the doctor has presented it to us, and the great advantage there is in studying it by means of the lantern. I know of one dental teacher who has a lantern set up in his own home, so that he can, while he is at work in his study, try his slides as he makes them. I might mention to you a method of preparing a slide, a diagrammatic slide, quickly, while you are in your study preparing for a lecture. This is by the use of thin artist's tracing paper of the most translucent type you are able to obtain. This piece of tracing paper can be placed over any illustration you care to use, tracing it with India ink—ordinary ink will do quite well. Such a drawing can be made in a minute and the tracing paper placed between two cover glasses, which need not necessarily be even sealed together, but can be put together with clips; the slide then becomes a useful one for your next day's lecture. These slides are exceedingly useful and quickly prepared, and they are diagrammatic. You can number them and letter them, as you please, and you can include more or less of the illustration as you please, in your slide.

The points brought out by the doctor in the preparation of cavity walls and enamel margins I have never seen so beautifully presented. I think we might improve some of our ideas of the preparation of enamel walls from this time on. At this late hour I have nothing more to say on the subject, but I should be glad to have the doctor, if the time allows, present his methods of preparing the slides that he has shown and go a little further into the lantern technic.

DR. THOS. E. WEEKS: The first part of the paper hardly admits of discussion—that histology should form one of the foundation stones of the dental student's education and should have a permanent place in the curriculum of every school. How you give it and when you give it, of course, depend largely upon your environment and conditions. With us it is given by the teacher of histology in a medical college. However, he is preparing a special course for the students. He uses the lantern in connection with his teaching—not exactly in the same way that Dr. Noyes has outlined, but to quite an extent.

We are endeavoring to follow along the lines suggested by Dr. Noyes as far as possible in the teaching of operative dentistry, applying the student's knowledge of histology to the practical preparation of enamel walls and margins.

The use of the lantern in the laboratory as Dr. Noyes has described, and in the lecture room as Dr. Smith has described, must appeal to every one of you as being very practicable, and being an adjunct that we cannot afford to dispense with, if we need any backing or authority. I might state that in the University of Minnesota there are to my certain knowledge, outside of the medical and dental colleges, eight lanterns in use; they are in biology, botany, mining and mineralogy, they are in chemistry, and they are in mechanics and physics—in fact, in almost all of the branches, excepting the purely classical. They are used by the teachers in all of the scientific departments, they are used and used to a great extent. Every lecture room is fitted, and some of the laboratories are fitted, so that we certainly can draw a lesson from that.

Dr. George W. Cook, of Chicago: It would be useless for me to attempt to add anything to what has already been said by Dr. Noyes. He is so well known as a teacher of histology that I could not possibly add much to a discussion of the subject. We should not lose sight of the fact that Dr. Noyes only uses the lantern as an adjunct to the regular laboratory work. The laboratory technic of histology is one of the best trainings that students get in technic work.

They learn considerable regarding manipulation in the histological laboratory. They learn a great deal in the hardening of tissues; they learn considerable about the use of certain agents. Dr. Noyes makes use of the lantern only as a supplement to his work, and, as we can all see, it is an important thing, because he brings out many points that the student who is not familiar with microscopy at all can see when it is placed before him with the lantern.

The subjects of histology and pathology are often neglected. I did not know until to-night that this was the first paper that had been presented on the subject of histology before this association.

Now, to my mind, if we are going to teach histology or going to teach pathology, the technic of the work is just as important as the technic of some other departments in school work. The basic principle of the sciences of dentistry and medicine is histology. While we are studying the man in the grosser form; while we are studying the aggregate of cells, it is well also to study the cell in minutiæ. The principle underlying the profession of dentistry is that of scientific work. What has made the dentistry of to-day has been the work that has been done in and along scientific lines. There has been great skill brought out, of course, by the technic work, but the sciences, such as histology, pathology, physiology and bacteriology, are the fundamental principles underlying the whole fabric of the institution called dentistry. Unless a student is more or less familiar with the minute structure of the tissues and of the organization of the cell structure he will never make a first-class dentist. He can have no idea of what will result from the application of drugs. The body as a whole should be treated as a single cell; it is only a community of cells, and one cell having been disarranged in any way may disarrange many cells, and the result is that if he treats the human body in any particular way to bring it back into its normal condition, he must treat it as a single cell, because the study of the single cell is the basic principle upon which lie the rest of the conditions of which he has got to treat.

As I said a while ago, the study of the sciences has made the profession. I would like to ask how many men there are in the dental profession to-day who are scientific teachers—teachers of the sciences, such as histology and pathology? Very few, very few! How many dentists go out from the schools that have anything like a knowledge of the fundamental principles of physiology and of histology? Talk about treating the human body with all the drugs that there are in the pharmacopœia when you don't know the first principles of the cell—the mechanics of the cell structure itself and the use of the laboratory and the lantern and the microscope is the only way that you ever reach the scientific treatment of dental caries or any other pathological condition that comes to the dentist for treatment.

Dr. W. E. Walker: I enjoyed the paper and the lantern exhibit so thoroughly I can certainly congratulate the gentleman in succeeding with it as he has. The lantern is used at the University College of Medicine to a great extent, but we have never brought out its usefulness in the preparation of cavities as has been done here to-night. This has certainly been done magnificently. I am teaching in the college pathology, therapeutics and pharmacology, and therefore I thoroughly feel that I should emphasize what Dr. Cook has said on the subject of going back to the cell. Our students are taught physiology by medical professors, and histology likewise. The professor of histology tells me that he has more difficulty in getting the dental students interested in histology than is the case with the medical students, who, as a rule, he says, seem to grasp—more than the dental students do—the fact that they are bound to treat the tissues from the cellular standpoint, and while they have studied the histology in the first year, by the time they come to me in the senior year I find that if they ever did know much about histology they have forgotten it, and while I use the lantern slides with them on the screen to good advantage, still I find that I cannot get into their minds a really correct comprehension of what the tissue is, unless I go back with them myself to the histological laboratory, and they cannot comprehend the pathological problems unless they understand the cellular arrangement of the tissue and the fact that they *are* treating *cells only* and never treating tissues. When they treat a tissue they must treat it from the cellular standpoint. It is difficult to get them to *think* in *cellular language.* While the lantern is very useful, I think I can offer an illustration here that will make it clear, as Dr. Noyes has said to-night, that it will never be more than an adjunct to the tissues under the lens of the microscope—for instance, take a set of photographs which have been prepared to illustrate travels in some distant land; a man who has made the trip, and who is familiar with the land can enjoy these photographs and understand them; they will bring back to *his* mind the ideas that he had at the time he saw them. Present them, however, to one who has not *seen* those lands and how inadequate is his conception of what the man *did* see when he was there; so, having studied histology, lantern slides bring us back to our studies under the microscope, but to the student who has not studied with the microscope, it does not give him any more *idea* of what he has *not* seen than the photograph of the traveled land does to him who really did *not* see the object with his own eyes. Those who have tried to study foreign languages know how hard it is to think in the studied language; one is inclined to think in his own language, and so, unless the students have a thorough microscopic grounding in histology and go back to it from time to time, from year to year, they do not learn really to think in cellular language.

DR. MERRILL, of Birmingham, Ala.: I thank the essayist for the additional illustration that he has given for showing the student what interest histology is to dentistry, in his setting forth how the knowledge of the direction of the enamel prisms is of advantage in the preparation of the cavities. And I think that all along the line of our teaching we will find that it is important to let the student see where what we teach is going to be of advantage to him in his professional work in his life after he leaves the college.

DR. N. S. HOFF: It seems to me that one advantage of the lantern is the same that we derive from any other method of illustration. It possesses the faculty in a peculiar and somewhat remarkable degree of attracting attention, and attention is one of the most essential features in teaching anything. Anything that will secure attention, anything that will concentrate, if you please, the attention of the class, as a picture on the wall will do, is of the very greatest value. I can very readily see how it would be of immense advantage to the teacher of operative dentistry in presenting such subjects as have been presented to us to-night, in the preparation of cavities, etc. To my mind, the lantern picture has not so much real advantage in teaching histology or bacteriology, for instance, as it has in teaching the subject to which our attention has been called this evening for the reason that looking at a lantern picture is like looking at a photographed picture. When you look at a picture on the screen taken from a microscopic slide, you get only one view of it; you do not have the opportunity of focusing the object as under the microscope, and you are never able to get the depth and the different views of the object as you would from looking through the microscopic section with the microscope, where you have the opportunity of adjusting it and getting the different views.

In teaching histology from the lantern view of the slide, while perhaps it does not distort the view, it enlarges it so greatly that it loses something of its value. A student perhaps cannot form any conception of the relative sizes of structures as exhibited by a lantern slide. He does not know how many times, for instance, that picture has been magnified. I don't know that that is a matter of great importance at any rate, as the matter of relationship is infinitely of more value, but of course we would like to know how big a thing is, or how little it is. Everyone wants to know this. We look at a tall building, or we look at a tall tree, we want to know how tall it is, and similarly if we see something very small we want to know how small it is. We like to weigh things in our minds. If we can get a mental conception of the comparative size of a thing we are able to mentally comprehend it. It is an advantage to see things in as nearly their normal sizes as possible and then to see them under known magnifications. In a lantern exhibit it is not always possible to explain definitely to a class what the difference in magnification may be, and it may be possible that in the teaching of the subject of histology the lantern slide may lose something of value or it may convey impressions that are not just what the teacher would like. If I were teaching the subject of operative dentistry by this method I would expect to have these same difficulties to contend with, but I can see that it is an appliance of very great value in teaching the subject to which it has been applied by the essayist. If I were teaching operative dentistry I should most certainly avail myself of this excellent method of illustrating this subject.

Dr. Henry W. Morgan, of Nashville, Tenn.: I arise for the purpose of complimenting the essayist of the evening on presenting this paper. I have witnessed many lantern exhibitions and have watched the progress of microscopic work under the hands of late Drs. Atkinson, Abbott, Heitz man Whitman and Dr. Boedecker for many years, but never until this evening have I seen exhibited the practical application of microscopic work to operative dentistry clearly, forcibly, and in a manner that cannot be questioned, but must be accepted by all those who appreciate the difficulties we contend with in the management of the enamel margins.

It emphasizes to my mind one other point—that the teacher of dental histology in dental schools ought to be a dentist, who understands the practical application of microscopic work and histology to operative dentistry. I thank the doctor very heartily for the pleasure he has given me this evening.

A Member: Suppose you come down and tell us, we would rather have dentists in all these chairs.

Dr. Morgan: I believe I am prepared to say yes. The manner in which the doctor has explained the necessity for beveling the cavo surface angle have been beautifully illustrated, and I am satisfied that the association has been highly honored in the presentation of the paper, and I want to congratulate the association on having the first chance at it outside of Chicago.

I wish to state the reason we have not had a paper on histology before is, this association could not go beyond the technic of practical dentistry until last year.

Dr. G. V. Black: I will not take up time, only to say that this is a field of work I have been immediately interested in, especially how to cut enamel to the best advantage, and how so to shape enamel walls and cavo-surface angles that they will be sufficiently strong. These things have been exceedingly difficult in teaching operative dentistry, and this mode of teaching, I find from practical results, is a great benefit; shortens the work materially, and gives the students a very much more comprehensive idea of the subject. Indeed, they grasp it very much quicker and more perfectly than by any other method of teaching that I have seen. I think a great deal of it.

Dr. Noyes: I do not wish to detain you; it is late now; but I feel that perhaps there are others as well as Dr. Smith who would like to have something more in regard to the technic of lantern work. In the first place, in regard to handling the lantern, as an adjunct in lecturing. I very much, personally, prefer to handle the lantern myself. I think that the value of the lantern in class-room work is very largely lost if the lecture room is so arranged that it is necessary to use an assistant. It is impossible for any assistant, no matter how well he is familiar with the slides, or the presentation of the subject, to handle those slides in the way that the lecturer wants them exactly. Aside from that, the lecturer will want to go back to a slide. For instance, in a lecture, I will have a half-dozen slides, or less. My lecture goes on; I use the blackboard, and I use pantomime, or clay or anything else in illustration; I come to a point where I can use the lantern, and I simply throw up the switch, put in the slide and my picture is on the wall. I can use my lantern in a room in which the light is simply prevented from falling directly on the wall on which we are projecting. You see that in this room, with full electric light, I get practically a perfect projection. The lantern stands right beside my lecture table, and I can point out anything in the field, with a pencil at the slide, or I can step to the wall and point it out. When I am through with that illustration I go right along with my lecture; I can then turn to the blackboard or to the clay and use that as an illustration; so, as Dr. Smith has said, the lantern is valuable to the lecturer as an adjunct just in proportion as it is easily handled. Then as you go through your lecture, you want to come back to a certain slide, you know just where it is, you do not have to talk to an assistant, which would distract the attention of the whole class.

The lantern in our school we use in two different lecture rooms, and in two or three of our laboratories and class rooms. It is constantly used in my laboratory, and for that reason we have had rigged up this sort of a table, that we carry around anywhere in the building, and all that is necessary is to screw the plug into the electric light socket and throw in the switch and it is all connected. It stands in the pit in the lecture hall and projects at a distance of about thirteen or fourteen feet, giving a circle, or a square, of something like eight feet, which is plenty large enough to be seen throughout the room.

In the technic of preparing lantern slides, of course I need not go into the whole photographic problem of the preparation of lantern slides. It may be well to explain, in the enamel illustrations, the preparation of the cavity is made on a photograph of a microscopic section. First a picture is printed from that negative and then the cavity is prepared by cutting out with opaque on the negative, painting the opaque on the glass side. It can be painted on the film side, but it is easier on the glass side, and less danger to the negative, and changing the enamel preparation by the way the opaque is applied. You obtain, in that way, the same effect which you would if you had cut the cavity in the section before it had been ground, but if you had cut it in the section before it had been ground, it would be infinitely more difficult to prepare the sections.

In the use of diagrams, as you notice, the slide I first had on the wall was a diagram which was made by photographing a drawing. You recognize it, probably, as one of the old illustrations. It was made from the india-ink drawing. The drawing was photographed and we obtained a negative, and the lantern slide was printed from the negative in the usual way. Of course that gives the most accurate reproduction of a text-book illustration which we can get, but it requires time to get the negative and make the lantern slide.

With certain photographic tricks we can shorten that time greatly. I often prepare two or three illustrations from our text books in the evening before my lecture, but it takes considerable time—the whole evening, nearly. In reference to the suggestion of Dr. Smith, that is, tracing on thin paper, I have used that and discarded it. I have used, also, tracings on ground glass. I used that at first, but discarded that. You will find that you can get still better results by simply taking the clear glass and add sugar to your ink. If you add sugar to your ink it will stick to the glass and you can make a tracing directly upon the glass with the ink and have a perfectly clear projection. Another method is to use the clear glass and flow over it then celloidin and let it dry. It will stick to the glass and give you a perfectly clear film. If you are too lazy to do that and are willing to waste the money, buy a dozen lantern slide plates, clear in the hypo, and dry the clear film, then upon that you can draw with water inks, not the insoluble India inks, but the water inks, in colors, as many colors as you may use, which dries in a few minutes. When you are through using it, wash the ink off and dry again, and it is ready for another time. You will find in tracing this way illustrations which you want to use, or diagrams which you want to make, you can do very quickly, very easily, and present them without taking the time to draw on the blackboard, and, in my experience, to very great advantage. If it is, however, an illustration from a text book which I want to reproduce as accurately and perfectly as possible, I photograph it and print it, and you can reproduce on the screen reproductions of illustrations from the text books as perfectly as they appear in the text. It requires just a little practice in the photographic technic. When I began two years ago I had never exposed a plate in my life, I had never seen a plate developed, and I want to say to you, to those of you who fear the photographic technic, it is not as difficult as you might believe, and it abundantly repays your effort.

In regard to the attachment of the microscope for projection, to this lantern, I had always supposed that in order to use direct projection it was absolutely necessary to possess the extremely expensive projection microscopes, which cost, I believe, $300 to $550. Well, it is not. The microscopic projection apparatus which I have, attaching to this lantern, cost only $10 altogether. It consists—I can show you in a moment how much time it takes to change it. You pick up your microscope from the table and turn it over at right angles and I have a board which is made with a socket to set my microscope on, so that when it is set in that socket and turned over it is centered; so that there is no time wasted in adjusting centers. All that is necessary is to put the slide on the stage with the microscope and project it. You can project with that perfectly simple apparatus with a two-thirds objective with perfect ease, and with a sixth objective, with a little greater care. I use occasionally a sixth, but I use chiefly the two-thirds objective. You get all the colors of the staining, all the perfections and imperfections of the microscopic slide, a very great help in connection with the photographs in laboratory work.

In regard to the application of the instruction to practice, it is in my opinion the salvation of the teacher of a theoretical subject in a dental school, the only thing which enables a man to hold the attention of a class on an abstract subject like histology or materia medica, is to make the students feel and keep them feeling that these abstract subjects are of every-day application in what they are going to do. Our work in histology is covered over in two years—general histology the first year, dental histology the second year—two complete years. Now I find every year men coming in will say: "I had both general and dental histology—I am all through histology, I don't want to take your histology." They are clamoring every year to get out of junior histology. But I find that about Christmas time I don't hear any more about it; they don't say any more about wanting to get out of junior histology. They have discovered, somehow or other, that that subject, which they considered as having nothing to do with the preparation of cavities and the filling of teeth, is really the thing which is of the very greatest importance. I tell my boys every year that the thing which has increased my rapidity of operation and my success of operation more than any one thing since I graduated has been the minute study of the structure of the enamel, and just in proportion as they study, in the operation, and before their operation, they will cut enamel easily and accurately and successfully, and before they get through they feel that, and as soon as they once feel it in regard to one thing in histology, they are willing to take your word a little bit that some of the other things which they did not see the application of really will have some application after a while. It is true of the anatomist. One of the most successful teachers of anatomy told me not long ago that the one way he was able to get men to work in anatomy was to show them at each lecture some place where a knowledge of anatomy had come in point in practice. And he made it a point of his study in every lecture before that class to bring out some case, either in his practice or some other, where his knowledge of anatomy had been of practical value to him as a practitioner. The same thing applies to histology knowledge and the teaching of that subject.

Now, in regard to one other point, I feel that the work on this subject has just begun. The application of it to the practice of dentistry has just begun. There are, as I might suggest now, a dozen different lines which have not been worked up, in which the structure is related to the practice, and those things are hungry for men over the country to become interested enough in them to work them out.

PRESENTATION OF THE TECHNIC OF CROWN AND BRIDGE WORK, METAL AND PORCELAIN.

By Thomas E. Weeks, D. D. S., Minneapolis, Minn.

In outlining a course in technic, three things should be kept in mind: First, to require the smallest number of pieces which will comprise the fundamental principles underlying the subject. Second, to select such pieces as will appeal to the student as being practical and as having some intrinsic value when completed. Third, to adopt those methods which are simplest and most direct.

Systematic technic teaching in dental colleges has passed the experimental stage, and there seems to be no question as to its value. It now behooves us as teachers to winnow out the chaff, which has been the chief cause of cheapening the article in the minds of the critical, and to leave only the sound kernels which are to furnish food for our children, the students. We must admit that in our earlier efforts we wasted time in repetition, which is seldom of any advantage unless it may be where the clinic is insufficient to provide practical cases. Then only such work is beneficial as will familiarize the student with the qualities and working properties of materials, or aid him in manipulation and construction.

Students usually perform in a perfunctory manner all operations in which they cannot see some direct value or bearing upon those things which they come to the college to learn. This fact should prompt us to select tasks that will be interesting, that do have value, and which appeal to the student as being practical. At the same time we must not lose sight of the necessity for cultivating manual dexterity.

No work should be required which at any stage presents conditions which must be imagined; *all* the conditions must be real. To illustrate: Plates may be made to fit models accurately, but the adapting of plates to the tissues of the mouth cannot be taught on models. Crowns may be perfectly fitted to natural roots mounted in models, but their relation to the surrounding vital tissues as presented in the mouth cannot be illustrated by models. Typical cavity form and the insertion and finishing of the various filling materials may be practiced upon ivory or vulcanite teeth, but the feeling and behavior of enamel and dentine vitally connected cannot be taught out of the mouth, to say nothing of the conditions which determine the outline of cavities and the shaping of the finished filling.

In a word, such portions of our work as are purely mechanical, that can be carried to perfection independently of vital connection, belong justly to a systematic and sequential technic course, while all portions which are governed or modified by vital relations belong properly to the lecture and recitation method, which, by the way, should be fully illustrated by demonstration. The subject should be carefully analyzed under the two heads of what to teach, and how to teach it. Under the first head should be considered the necessary operations, their relations to the vital, mechanical and æsthetic conditions and the causes of failure. The second head should consider what must be taught by precept and example, and what may be accomplished by practice. This last having been determined, it remains to set such tasks for the student as will best fit him for the performance of the operations in the mouth.

In pursuance of this plan we would consider under the subject of crown and bridge work:

First. Those operations which supply useless or missing natural crowns by artificial ones of metal or porcelain, or a combination of the two substances, attached to healthy roots.

Second. The attachment to the root, the health of the root and surrounding tissues, the relation of the new structure to these, its neighbors and its antagonists.

Third. Contour of the surfaces from the physiological, mechanical and æsthetic standpoints, and the formation of articulate sounds.

Fourth. Occlusion and articulation, that will perform the function of mastication.

Fifth. Proper form, bulk, etc., of posts and ferrules or bands, and the correct preparation of roots.

Sixth. The causes of failure, which include insufficient strength of structure, unwise selection of the kind of crown in a given case, and neglect or ignorance of the principles already enunciated.

Analyzing the subject under the second head, we find that the construction of crowns and bridges is almost entirely a laboratory process, and that by using models, properly articulated, bearing na-

CHART.

	Class. (Anchorage.)		Subclass. (Material and Construction.)
1	Those depending upon a dowel-post in the root for anchorage.	1	All porcelain crowns without ferrule.
		2	All porcelain crowns with ferrule.
		3	Metal and porcelain crowns without ferrule.
		4	Metal and porcelain crowns with ferrule.
2	Those which as caps envelope the stump of a crown and depend upon it for anchorage.	1	All metal shell or jacket crowns.
		2	Metal shell or jacket crowns with porcelain facing.
		3	Porcelain jacket crowns.

tural roots, we may teach in the laboratory the construction of every variety of crown and dummy; the proper form of posts and ferrules, and their adaptation to the roots, with proper contour, contact and occlusion. The other points which relate to vital and artistic conditions must be taught by other methods. As the number of crowns differing more or less in construction is legion, it is wise to separate them into classes:

First, those based upon anchorage, or manner of attachment.

Second, those based upon materials and construction. (See chart.) No matter what the material or the method of construction, all crowns depend upon either the dowel post or the ferrule, or a combination of both, for their attachment.

As no single material or type of construction is indicated in every case, and as each of the seven subdivisions furnish crowns which are indicated above every other under certain conditions, a complete technic course must include the construction of at least one of each type.

On the model before you is illustrated the course selected by the author as best fulfilling the conditions. It comprises:

First. A Logan or other ready-made crown without a band—on the right upper central incisor.

Second. A baked porcelain crown without a band, on some tooth.

Third. A Logan or similar crown with band, on right upper lateral.

Fourth. A baked porcelain crown with band, on right upper cuspid.

Fifth. A metal and porcelain crown without band, on right upper central.

Sixth. A metal and porcelain crown with band, on left upper cuspid.

Seventh. A metal shell crown, on left upper first molar.

Eighth. A metal shell crown with porcelain facing, on right upper second bicuspid.

Ninth. A porcelain jacket crown, on peg-shaped right upper lateral.

Tenth. A metal shell crown with labial face cut out to show the natural tooth, on right upper cuspid.

Eleventh. A metal and porcelain dummy soldered, for left upper first bicuspid.

Twelfth. A metal and porcelain dummy, facing removable, for left upper lateral (resting on gum).

Thirteenth. An all metal dummy, for left upper second bicuspid.

Fourteenth. A metal and porcelain dummy, removable facing, for right upper bicuspid.

Fifteenth. A baked porcelain crown, on right upper second bicuspid.

Sixteenth. A baked porcelain dummy, for right upper first bicuspid.

These several operations when Nos. 6, 7, 11, 12, and 13 are combined in one bridge; Nos. 8, 10 and 14 in another, and Nos. 4, 15 and 16 in a third, give us such a variety as to include all the principles, materials and methods of construction.

Having decided what shall be included in our technic course, that is, what to do, we are ready to determine how to do it.

In the first place, all the students should have models which are alike; to insure this, a number of tin models are prepared, which possess the necessary qualifications. These are issued to the students, who at the same time are provided with the necessary teeth and roots upon which to build the crowns. Thus provided, they make plaster models with the roots in their proper position. These models, with the lower ones, which are properly articulated, are mounted in a Bonwill or other anatomical articulator. This work must be done under the close supervision of an instructor, in order that the models shall be properly constructed, with the natural teeth and roots in their proper positions and relations.

As all the operations require the use of a metal to some extent, it becomes necessary to select a metal which will best meet the requirements. After experimenting with copper, brass and German silver, they have all been discarded in favor of aluminum bronze, which is easily swaged, fuses at a high temperature, consequently is not easily burned, oxidizes less than the other metals, and presents, when polished, a color closely resembling gold.

The one objection is the expense, but as the quantity used is so small, the expense is harldy worth considering. The posts may be made of German silver.

Two grades of silver solder having such difference in the fusing point that the low grade may be fused upon the high grade, are necessary. The high grade is used in the construction of all crowns and dummies, while the low grade is used for uniting these in the completed bridges. In the baked porcelain crowns no metal has been found which takes the place of platinum; on account of the expense it is necessary to make the posts much smaller and the caps much thinner than would be indicated in practical work. This, of course, necessitates impressing upon the student the proper size of post and thickness of metal for the cap when used in the mouth. In the soldering of this work, a solder of eighty parts of pure gold and twenty parts pure platinum, is used for uniting bands, caps and posts, while pure gold is used for uniting the pins of the facing with the post. This latter is done to avoid the danger of changing the color of the facing under the high degree of heat which is necessary to fuse platinum solder.

In preparing roots for all crowns which use the dowel post, ferrule or band, there is a wide divergence in the practice of different operators. However, there are certain principles which must be observed. The first is that where the band or ferrule is employed, that portion of the root which extends crownward from the gingival line, must be slightly larger in circumference at the gingival line; the second is that the end of the root should be so formed as to present a firm seat for the crown; this is true whether there is a band or not.

In the construction of any porcelain and metal crown, for the ten anterior teeth, it is desirable that metal should not be apparent on the labial surface. To insure this the labial half or third should be shortened so that the free border of the gum will cover the band in this locality. This is illustrated in the preparation of the cuspid, incisor and bicuspid roots. The first preparation is where it is necessary to supplement the post by retaining some considerable portion of the linguo-gingival ridge; this may be employed also in metal and porcelain crowns where the lingual surface is contoured with solder, as it results in a saving of solder.

The second form is used where the occlusion is such that the linguo-gingival ridge must be sacrificed in order to insure strength in this portion of the structure; it is chiefly indicated for the baked porcelain crowns. The preparation for crowns without bands is illustrated by these two central incisor roots. The preparation of the labial portion of each is identical; the difference is that in the first the root is so shortened throughout its whole circumference that the joint between crown and root is covered by the free border of the gum. There are times, however, when it is desirable to expose as much of the joint as is possible under æsthetic laws to the cleansing action of the tongue.

In such cases the second form of preparation is indicated.

It is not the purpose of this paper to discuss the question as to the necessity for devitalizing pulps in all cases where the jacket crown is employed, but so long as many good operators continue to adjust such crowns in selected cases without devitalizing, it is competent to consider one or two rules based upon principles. It is not necessary that the *diameter* of the stump in every aspect should be greater at the gingival line; but it is necessary that the *circumference* should be the greatest at this point. If the mesial and distal walls can be so formed as to show a decided central inclination either the buccal or lingual wall may show a convergence from the central axis. In such cases the opposing wall must be almost or quite parallel with the central axis. With the proper form and construction of the occlusal surface it is not always necessary to remove all of the enamel upon the occlusal surface.

The preparation of the right upper lateral, cuspid and bicuspid and the left upper molar will show such preparation as might under certain favorable condition, dispense with the devitalizing of the pulps. In the construction of dummies there are two types—those which rest with equal pressure upon the gum throughout their whole circumference, and those in which the lingual surface is cut away in such a manner that only the labial or buccal edge of the gingival end comes in contact with the gum. As both forms are employed the course should comprise them both.

As each operation upon the model comprises something of interest, either in principle or construction, we will take them up in regular order. In most of the operations, the steps have been illustrated in detail. The heroic model is a reproduction, enlarged ten times, of the upper model used by the students, and saving the relation to the teeth of the lower model, the work is constructed as in the smaller model. Because of the difficulty in manipulation, the thickness of the metal is less than ten times that of the metal used by the students—that being twenty-eight gauge for caps, shell crowns and dummies, and thirty-six gauge for backings, in all operations employing the bronze. In all other particulars we have striven to observe proportion.

As the central incisors are generally teeth which indicate the application of a porcelain crown without a band, the right upper central is selected for the first operation.

The crown is cut off to within one millimeter of the gingival line; this gives it a concavity from mesial to distal, and a plane surface from labial to lingual. For the purpose of cheapening the cost of material, an old-fashioned pivot tooth is selected and ground to fit the root. The canal is now enlarged for the reception of the dowel post; when so enlarged, the opening presents an oval form, having its greatest measurement labio-lingually. A post of German silver, having the form of a parallelogram in cross section, is fitted in the enlarged canal.

The projecting end is cut off to the proper length, and made to fit accurately into the recess in the porcelain crown. After fixing the post in the recess with cement, the crown is ready for final adjustment. This crown is fitted to the root in which the preparation permits the joint to be covered by the free border of the gum, and teaches the making of posts and the grinding of crowns to fit the end of roots.

As lateral roots often indicate the use of a ferrule the right lateral has been chosen for the porcelain crown with band. In this case the root is prepared much the same as for any dowel post crown with a band; special care must be taken that the end of the root is so formed that the band cannot under any conditions creep up to impinge upon the tissues at the gingival line; the crown is adapted into the coronal edge of the band by grinding and swaging. The same kind of tooth is used here as for the central, and the post is fixed in the recess in the same manner. This is operation No. 3 and gives the student his first lesson in making and adapting a band to the root. For the same reason which prevailed in the porcelain crown without a band we may select the right upper central incisor for operation No. 5; the metal and porcelain crown without band. This operation consists in burnishing a thin plate of metal cut to the outline of the root, against the end of the root, passing the post which has been previously fitted into the enlarged canal, through a perforation in the center and uniting the two with solder. After being assured that the metal plate fits the root perfectly, the facing is ground to fit, backed properly with metal and fastened to the post. The crown is now completed with high grade solder which unites the facing, plate and post, and completes the lingual contour. In this operation the student learns to properly shape a facing; to apply a metal backing properly, and to flow solder in sufficient quantity to form contour. He should also be impressed with the necessity of having the metal on lingual surface strong enough to resist all stress, thus protecting the facing from fracture.

In operation No. 6, metal and porcelain crown with band, the method and lesson is the same as in No. 5, after the construction of the cap. Here the student should learn the proper construction of caps for all types of crown where they are employed as a foundation.

Operation No. 7, gold shell crown, teaches the adaptation and shaping of a band of sufficient width to form the axial surfaces of the completed crown; the carving of a model for the occlusal surface, the making of a metallic die or matrix in which the occlusal surface is formed, and the reinforcing of this occlusal surface and uniting of it to the band with solder.

In operation No. 11, metal and porcelain dummy with a so-called self-cleansing lingual surface, teaches that the facing in this case requires a different form from those already adjusted. It also teaches the construction of an occlusal surface and its proper adaptation to the facing, besides giving further facility in the forming of contours with solder. By this time the student has probably learned that it is possible to crack porcelain facings in the soldering process, and will doubtless welcome the instruction given in operation No. 12, where he makes a dummy for the left upper lateral, with the facing riveted to the metal work after the soldering and finishing is complete. He also learns how to construct a dummy whose gingival end shall be accurately adapted to the model. As the several pieces comprising the first bridge are now complete, it remains to assemble them in their proper relations and unite them with low grade solder. When this is accomplished the student should have gained sufficient knowledge and ability to enable him to perform the simpler operations of crown and bridge work. He should at least be fitted to go on with the more advanced operations which are intended to give him greater facility, and show him how the various methods may be adapted to varying conditions.

While the hood crown or shell, having its labial surface cut away to expose the natural tooth, is not often indicated, its proper construction ought to be taught; for by the difficulties in its construction will the student be made aware of its weaknesses, and be better able to select such teeth for the operation as will promise success.

In operation No. 8, the student gets opportunity for further practice in the construction of a shell crown and learns how to solder porcelain without investment. In No. 14 he has opportunity to further perfect himself in making a metal and porcelain dummy, and the adapting of the riveted facing under a little different conditions.

In the completed bridge he has opportunity to correct the mistakes of the first one and show progress.

Porcelain Crowns and Bridges.—As there are certain principles underlying the construction of porcelain work, it seems wise to consider it apart from the other work. There seems a growing tendency in the profession to use porcelain, so the teaching of its proper construction is indicated in a complete technic course.

The first principle governing construction is that the metal foundation or framework should possess sufficient strength to withstand all the stress of mastication.

The second is that the bulk of metal should be so placed and distributed that it will give the greatest possible bulk and strength to the porcelain. Third, the attachment of the pins to the metal foundation should be as far rootward as possible.

Fourth, all joints must be in perfect apposition and united with a solder which will not change under the heat necessary to fuse the porcelain.

Fifth, the utmost cleanliness must be observed in every step of the operation.

Sixth, the body should be of high grade, finely triturated and laid in such a manner that it will present a solid homogeneous mass when fused. If all these rules are observed there is no operation which fulfills so perfectly the æsthetic requirements, and when we consider that in porcelain faced metal crowns and dummies, the pins of the facing usually limit the strength of the work and that in many cases it is impossible to provide sufficient strength, we will conclude that the porcelain crown will not fail us in point of strength.

In the construction of the crown for the upper cuspid (operation No. 4), there is illustrated, first, the proper preparation of the root to allow sufficient bulk of body in the linguo-gingival ridge to insure strength in this locality.

Second, the proper shaping of the facing and its union with the dowel post. In the crown for the right upper bicuspid there is taught, in addition, how to construct a cap with two posts in such a manner as to support the lingual cusp. In the joining of these two crowns by swinging in a dummy for the first bicuspid space, the proper construction of the framework of a bridge is illustrated. In the construction of the crown without a band for the right upper central (operation No. 2), the method of procedure, saving the cap, is the same as operation No. 4, and gives the student opportunity to learn the manipulation and fusing of the body before he applies the body to complete the bridge.

In presenting this outline of a technic course there is no claim to originality of method and if proper credit has not been accorded the originators it is because the sources are so numerous that it would be difficult to mention them all. The author, however, desires to express his appreciation of all the assistance he has received from many sources. Detail of method has been omitted because it seems unnecessary to enter into details before such an audience, furthermore the object has been to suggest operations illustrating principles rather than to exploit methods.

DISCUSSION.

Dr. N. S. Hoff: Dr. Weeks has talked so long on this subject, I have no doubt you are all tired of it, but Prof. Brophy tells me that Dr. Weeks is going to make a present of this model to each of the colleges represented here to-day. I don't want to criticise him too much, for fear he will leave my school out. I have been trying to think of some nice things I could say about it so that I could cheer him up a bit and make him think it is worthy to present. It is certainly a beautiful model; it is the nicest thing of its kind I ever saw, and the most practical.

Without entering into any criticism, if I were disposed to, of the work which he has presented to us, the form of the work, the method of presenting the work to the class, in the class-room, it seems to me that it is so commendable I fear we shall all be dissatisfied until we have possession of these facilities. If we can get it out of Bro. Weeks, it will save us a whole lot of bother and trouble; if we cannot, then we shall have to make it ourselves. We must each have a model like it.

He has mentioned so many things that are perfectly obvious to us that simply the mentioning of them is enough to carry conviction and need no great elaboration.

There are some thoughts in his paper that struck me very forcibly, and one is the thought that whatever we teach in these technic classes should have a practical bearing. Now I think that this is a very important feature—it is not only important in the subject which I tried to talk upon this morning, that is, getting at the student himself; to teach from his standpoint. We all know how often it occurs, particularly with the first year men, how they will come to ask about this, that and the other piece of work they are about to do. "Is this anything I am ever going to use?" or, "Is this a practical thing?" I don't know where they get that notion, that things are not going to be practical that are taught them. It seems to be either their fault or the teachers, I don't know which. If they don't see the direct application of it at once, they do not feel that interest in it that they do if they can be sure that it is to be something they are to utilize by and by. This may come, of course, as a fault of the circumstances which brought them into the study of dentistry as a profession. It is a thing, possibly, sometimes, that we need to educate them out of, but we must take advantage of this fact; it predominates their minds to such an extent that it seems to me we do not do ourselves justice, we do not grasp all the opportunities we have, unless we do take advantage of such conditions. When we have educated them out of such ideas, then we can present more abstract teachings, perhaps. So if we can show them such models as these in an attractive way, just what the thing is to be when it is done, it is a great point gained. If we can by any combination of means or circumstances present to them a form of teaching which commends itself to their minds at this time, it seems to me we have got the advantage of them. We are getting hold of them in their own way, taking them on their own grounds as they are, and we have an opportunity then to appeal most strongly to them.

We must not, however, spend too much time in catering to the student. Some of us may think, possibly, that the sooner we get the student out of that attitude of mind, the sooner we will get into the mind the proper method of doing his work, or the sooner we can make him follow our dictation, the more power we shall have with him. But this, in our experience, is not true. We must adapt ourselves to the material we have and adapt ourselves to our circumstances. And all such things as this are helpful. You cannot describe these different methods to a class so well without an illustration as you can with them. Possibly some of the methods the essayist has advocated do not appeal to all of us, but we can very easily adapt to this model any peculiar method of our own and make the idea ours.

Dr. Weeks recommends the use of high fusing material for the making of experimental crown and bridge work. Now we do not in practice use high fusing material always in making crown and bridge work. We use a great deal of gold—perhaps the large majority of cases made with gold as the metallic substance—we use very little platinum, except in porcelain work. The teeth which we use in making crown and bridge work will not stand the high fusing solder which he advocates, and I think it is very much a question whether brass, after all, is not more nearly similar to gold, so far as the fusing point is concerned, and whether we cannot better teach by using brass in place of this aluminum bronze, because it simulates the material in which the students will work in practice. The fusing points are more nearly similar; the methods of working are more nearly similar. I have never used this aluminum bronze, but the statement that it is used because it has a high fusing point, it seems to me, renders it objectionable for technic purposes. To my mind any one who can use brass in technic work can use gold in practice. We use brass solder in place of silver solder, and brass plate as a basis of all technic work. A solder made of copper, silver and zinc fuses slightly below the fusing point of brass plate, and so near that that it simulates more closely the use of gold solder on gold plate than the platinum or silver solder does on this bronze, and so I think that if we are going to keep up this idea of doing those things that are practical, we must keep as close to the practice as we can. If we cannot use the gold because of its expense, we must use the thing that is most nearly like gold to be consistent. When I want to illustrate the use of platinum I use German silver as a substitute for platinum in technic work. I use copper where I would use pure gold, as a substitute for pure gold, and brass where I would use gold plate.

Dr. Hillyer: Dr. Weeks mentioned that some one has criticised the fact that his model is in one piece. I think it an advantage for the student to be able to assemble his work on one model.

I want to speak of one criticism which I heard in the adjoining room of one particular crown which is placed upon that model; and that is the hood crown. While many of us would not make it in our own practice, if we could possibly avoid it, there are those who go out from college that are called upon to make that crown, and consequently it becomes necessary that they should be taught that just as much as any other construction.

Dr. Hart J. Goslee: I am very glad indeed to have had the privilege of looking over the paper of the essayist this morning. It was given to me late last evening, and I glanced over it casually during the discussion of the preceding paper, and it is a splendid presentation of the subject of the technics of crown and bridge work, and I should like to have had time to go further into the discussion than I will be enabled to, and even devote, perhaps, as much time to discussing it as Dr. Hoff did to Dr. Peck's paper this morning.

One of the first things that the essayist referred to was that of wasted time in repetition in the teaching of technic work, and I would take exception to it in a general sense from this standpoint, that if we have the time to devote to it, in that allotted for technic work of this nature, we cannot give the students too much, even though they may make two pieces identically the same; because they are benefited by each one, and while I would not advocate by any means that time be wasted in useless repetition the students cannot get too much of it.

They should have a great variety of ideas given them. Dr. Hillyer has referred to the hood or jacket crown, and while we know its application should not be generally practiced, the student should be taught how to make one, because sometimes they are indicated. For instance, in an extensive lower bridge, perhaps extending from the cuspid to the second or possibly even the third molar, I feel that a hood slipper or jacket crown for that cuspid tooth would often be the very best thing that we could possibly put there, because it would be much stronger than if we cut the cuspid clear down to the gum line and put on a dowel crown, especially if there was considerable absorption. So we must teach everything that has any practical bearing. We should condemn it where it should not be used, and teach the student only to utilize it in those places where it is specially and directly indicated.

One of the crowns referred to by the Doctor in his essay, styled the jacket crown, I would criticise. The jacket crown as described is to-day practically obsolete, and to it as much as anything else that I can conceive of just at the present, is due the condemnation by a great many of the application of porcelain to crown and bridge work. When you slip a thin matrix of platinum over the protruding and projecting end of a tooth it does not leave room enough for porcelain, and never possesses strength enough to be permanent. I have made a great many of them, and seen many made by men distinguished in this line of work, but most often they are failures, because you do not have room enough for the porcelain—and the strength of porcelain increases in proportion to its bulk—so you must cut the tooth down to make room for it. Such a crown might possibly be indicated on teeth where you do not know how long the root may be, or whether you can get a post in it or not, and in such instances should be invariably applied to gold and not porcelain in combination with a facing.

The essayist approves of the construction of the work on plaster models by the students, which I have abandoned entirely, because I feel that to do it successfully the student must have a model that is practically indestructible. Four years ago I presented to this society a little method of combining metal with the plaster model so that you would have a portion of it indestructible. Tin models are made, to be used for taking impressions, shaped as desired for the bridge or crown and an impression in gutta-percha, of the working part of it then taken and filled with fusible alloy or tin, making a metal working portion, then another impression of the entire model in modeling composition is taken into which is placed this metal portion, which is then filled with plaster, and we have a plaster model with the exception of the working part, which is metal and indestructible; which is of advantage, of course, over the plaster, because the student can do all the work he wants without any danger at all of destroying the model on which he is at work.

A very commendable thing which he made reference to in the teaching of crown and bridge work, was the use of anatomical articulators, and I want to say that I believe it is just as essential to construct a bridge upon an anatomical articulator as it is a plate. We do not use these articulators enough. A great many bridges break and fail simply because they do not properly articulate, and do not admit of the lateral movement that we get in the natural articulation.

I criticise, like Dr. Hoff, the use of aluminum bronze and agree with him in that we should teach the students to use a metal as nearly similar to that which they will use in practical work as possible. Two years ago in presenting a syllabus of prosthetic technics to the committee appointed for the purpose, I suggested and stipulated that brass should invariably be used in the teaching of technic work wherever gold would be indicated practically; that pure copper should be used wherever pure gold would be practically indicated, and German silver where platinum would be indicated, and I believe it is the only method by which we may familiarize the student with the fusing points and characteristics of the metal that he is going to use when he applies them to practical work. Aluminum bronze does very nice work, I have no doubt, but it is harsh and stiff and unlike gold in its working qualities, and I would never have a student construct something of it that would represent something constructed of platinum later on in practical cases.

Another thing the essayist referred to was the use of very thin materials in the construction of porcelain crowns and bridges, because of lessening the expense. Just the minute we begin to teach the student, even to permit him, to use a thin material for technic work, we will lead him to think that probably he can do that in practical cases to cut down the expense; and I believe that we ought to vigorously require him to use a material for his technic work, in thickness as well as in fusing point, that he would have to use for practical work.

The use of platinum solder in single crown work, which the essayist speaks of, is entirely unnecessary and not at all indicated. The point made in favor of platinum solder for porcelain work is this: that it enables you to use a solder which does not fuse or melt at the fusing point of the porcelain in the furnace. If you have perfect contact between the parts, and solder with pure gold and fuse that pure gold perfectly it becomes absorbed by and alloyed with the platinum, and you have a joint that is just as strong as you can possibly get with platinum solder. The trouble is that they use, as a rule, entirely too much pure gold and do not apply heat enough to fuse it down well so that it will flow over the surface and become alloyed with the platinum, with the result that when it is placed in the furnace covered with body, the pure gold then melts and is absorbed, leaving a space, if you please, which invariably causes porosity of the porcelain.

Two contact surfaces of platinum can be soldered with pure gold, placed in the furnace along side of porcelain, and you cannot separate them when taken out of the furnace. The joint is perfectly brazed.

I criticise in a sense the essayist's method of root preparation, for I believe, gentlemen, that one of the greatest mistakes in teaching crown and bridge work is in neglecting the essential requirements of root preparation; for the reason that we know one of the greatest causes of failure in this work is the neglect shown this very subject. Whether it is necessary to devitalize teeth for a shell or telescope crown is not to be considered here, but it is necessary to sacrifice enough of that tooth to properly reduce the dimensions and circumference equal to the cervix. If you do not, you will never have a perfect fit.

Probably if we had some kind of instrument that would go around the neck of a crown after it had been mounted, burnishing it in to the root at all points, then we might negligently treat root preparation. So long as we have not an instrument of that kind, however, we must have the root prepared so that the band will fit, up under and within the free margin of the gum.

Reference was made to the changing of the color of facings in soldering. Even where pure gold is used, there is no occasion at all for the bleaching of facings, and I predict that not one in a hundred will change materially if selected with a knowledge of their capacity for heat. I do not have that trouble myself with the teeth that I now use for porcelain work and have not had for some time. Some teeth will, of course, bleach at the fusing point of pure gold to some extent; but if they bleach there they will in the furnace too, so that they should not be used.

The essayist refers to the two central incisors as being practical indications for the use of crowns without bands; but I differ with him there, because I do not believe that when we find sound tooth structure, there is a tooth in the mouth where the crown without a band is indicated. Most often the indications for a crown without a band are in those cases where, because of extensive decay, you have no chance to band, but certainly not on good healthy sound tooth structure, because of the fact that the band adds such additional stability to the crown (if the root is prepared properly and the crown fitted properly) and the immunity from decay it affords, as well as from a possibility of fracture of the root, demands that we almost invariably place bands upon every tooth that we hope to crown permanently.

I do not think that too much stress can be laid upon the strength of the metal parts in porcelain work, and have treated that subject in a more or less exhaustive manner in two papers in the last year and a half, one of which has been published in the DENTAL REVIEW, the other of which will be published in the *Cosmos* of next month. The metal construction that I have advocated and taught is almost identical to that which the Doctor describes here—which is very beautifully illustrated, and which will show you that the bridge itself, or even the crown, should possess strength enough in its metal construction, before the porcelain is added, to almost withstand the stress of mastication.

The lingual supports which the doctor has on these models, if you will remember, those projecting spurs, which support the masticating portion, are absolutely indispensable. One of the greatest failures we have had in this line of work in my observation, is the breaking away of that lingual mass of porcelain, because it was not supported, to overcome which I devised these spurs, and you will have failure with your work unless you place them there, or something else that will take the place by preventing cleavage in the stress of mastication.

I think, gentlemen, that as a suggestion of the principles involved in the teaching of the technics of crown and bridge work on the whole, and as a method of illustrating those principles, the essayist has done admirable work, and that this society should give him a vote of thanks for the most excellent presentation of the subject.

THE PRESIDENT: Dr. Weeks, will you kindly close the discussion now?

DR. WEEKS: I know of no better way of closing the subject than to simply veil the model.

CLASS-ROOM METHODS OF TEACHING ORAL SURGERY.

By G. V. I. Brown, A. B., D. D. S., M. D., Milwaukee, Wis.

The successful teacher of oral surgery, as, indeed, of any other branch, whether in a medical school or elsewhere, must depend for success upon order, attention, thought. To have these he must awaken the interest of his pupils, and in order to do this he must be prepared to select for them just so much of the subject as it is essential for them to acquire, to present these facts in such order that their relation to other portions of the subject may be quite clear, and the impression so strong that at least matters of primal importance may remain fixed without confusion in their minds, at the same time more advanced thoughts should be given which will tend to suggest reference to books and other literature with a view to becoming more widely enlightened upon the subject.

The real topic for our discussion is as to the most ready means of approximating this idealistic result, and it would seem as though the following maxims laid down by those for whom pedagogy has been the study of a lifetime, might aid us in this respect.

1. Attention is the condition of knowledge.
2. Mental growth depends upon attention.
3. Memory and perception depend upon attention.
4. Teaching power is determined by the power to secure attention.

It seems to me that if we would learn principles systematically rather than so much, we would have more knowledge at our command. If we could see the thought as developed in any subject just as we should and must see the thought in reading—and not only see the thought in one subject, but be able to follow it through every branch—then our knowledge would be systematic.

The seven laws of teaching (Gregory).

1. Know thoroughly and familiarly whatever you would teach.
2. Gain and keep the attention of your pupils, and excite their interest in the subject.

3. Use language which your pupils fully understand, and clearly explain every new word required.

4. Begin with what is already known and proceed to the unknown by easy and natural steps.

5. Excite the self activities of the pupils, and lead them to discover the truth for themselves.

6. Require pupils to re-state, fully and correctly in their own language, and with their own proofs and illustrations, the truths taught them.

7. Review, review, review, carefully, thoroughly, repeatedly, with fresh consideration and thought.

Nothing is more distressing than to witness a lecturer, manuscript in hand, reading to his audience, unless perhaps it be one who for want of manuscript goes haltingly through, repeating and confusing both himself and his auditors. Between these two extremes of bad illustration of both methods must lie the indication for a proper delivery. In other words, one should neither depend upon a written manuscript nor entirely upon an effort of memory, but should be prepared to speak directly to his listeners with full opportunity for his personal magnetism to keep him *en rapport* with those he desires to impress, able to follow uninterruptedly with his eye the effect of every word, without confinement as to exact phraseology, but ready to change instantly the selection of a word in order that some more striking illustration be used, yet with memoranda for occasional reference to enable him to speak consecutively upon the various divisions of the subject.

Recitational methods are fast supplanting other means of instruction and the results from the standpoint of the acquirement by the student of a limited number of facts certainly seem to justify this change, no longer is it possible for the somewhat picturesque lecturer of a decade ago to adopt the mannerisms of the rostrum once considered such an important feature of medical and dental college instruction, and yet there is perhaps another, little-thought-of, side to this question, for where can a man of high thoughts and firm convictions so deeply imprint the image of his better, more truly ethical self than when as teacher to pupil he speaks of those principles of practice which are at least an echo of all that he would have been, even though not quite what he really is, and without some such uplifting suggestion where is the knowledge of professional feeling to be fostered?

It often seems to be necessary to refer to parts of a subject that properly belongs to another chair, and in this way students are frequently obliged to listen to lectures upon the same subjects from several different professors. This may be avoided in a large measure by reference which will be sufficient to awaken interest without destroying it by repetition, and when in the regular order the subject is reached, much greater benefit will be received by the student and an unnecessary confusion will have been avoided.

The lectures upon inflammation, its etiology and pathology, and treatment, may with considerable advantage be so conducted as to occur at about the same time that the lectures upon operative dentistry are treating of pulpitis and other diseases of the dental pulp. Abscess can follow or precede, with benefit, lectures upon alveolar abscess, pyorrhoea alveolaris and similar affections of the oral tissues which are still within the recognized limits of the course upon operative dentistry, and an added interest will be given to many parts of this subject when properly identified in near relationship to septicæmia, pyæmia, necrosis, caries of bone, and gangrene. The work of the professor of therapeutics can be greatly facilitated by arranging to have his lectures so directed that remedies, the administration of which he is teaching, will be those best applicable to the treatment of diseases which the oral surgeon is describing at about the same period in the course. We have found it extremely satisfactory in our work in the Milwaukee Medical College to have Professor Hill, who teaches therapeutics, give occasional joint lectures with me. By previous arrangement he enters just at the precise moment when I have finished the consideration of etiology, symptomatology and operative treatment, then he follows right on with other treatment, requiring members of the class to go to the blackboard and write prescriptions, subject to discussion and revision by fellow students.

Attention should be called to the importance of a thorough understanding of anatomy, emphasis given to the anatomical relation of associated parts, vessels, nerves, etc., but instead of trying to give a review of the subject the class can be notified that questions concerning the anatomy of the field of operation will be included in all examinations. Students are then obliged to turn back to the pages of their anatomy, closed perhaps with final intent at the end of the second year.

Consideration of surgical cleanliness and aseptic precautions refers directly to bacteriology. Here, again, time which would be otherwise taken, can be saved, if attention be called to the benefits to be derived from care in this direction, and the danger to be apprehended from pathogenic bacteria, particularly such as have an especially pernicious influence, all of which they must prepare themselves to be informed upon at examination time.

Embryology, histology and pathology can each be treated in the same manner.

Orthodontia can be given an added impetus also, because it is upon the principles taught in the technic and lecture courses upon this subject that the preparation of many of our best and newest splints depend, and deformities of the jaws are concomitant with many diseased conditions calling for our treatment.

Even chemistry is woven into the woof of this surgical garment, through its bearing upon examination of urine, blood, and secretions of those organs which we in common with all other surgeons must look to for indications to determine indications or contra-indications for operation.

Hygiene forms an important part of many subjects, while ethics must be carried like a golden thread throughout the entire length and breadth of the course, always in evidence, ever shining to light toward higher and better things.

Thus it will be seen we have gathered within the fold of this one chair the essential portions of every branch of the entire curriculum.

This has been done naturally without serious effort and without any special loss of time—in fact, with a notable saving of time. In so far as we have obliged the students to study out for themselves those subjects which they are required to know, and to rely upon their own knowledge, rather than that imperfect comprehension, which will certainly result from an effort on the part of the lecturer to include these subjects, exhaustedly in his discussions.

This method not only benefits individuals of one class, but its influence also spreads among the other classes, which are still struggling with the discouragements of the theoretical work of first and second years, and becomes a powerful factor in forwarding the study of these otherwise uninteresting branches.

Thus, in a way, it leavens the work of the entire school.

It seems to me that in each college there should be at least one chair which would follow this idea. If the criticism was in order, it might be that colleges do not give enough consideration to the comprehension by the student of the course of instruction as a whole, and too often that interdependency of different parts is overlooked.

I would not urge that the chair of oral surgery be always and in every case a nestor for the other branches. It does not follow that this necessarily must be so, yet it certainly seems to offer a most favorable opportunity for illustrating the direct bearing which each one has upon the other in the completion of the structure, which, as a whole, we are undertaking to build up.

It is an indisputable fact that since we must learn through our senses, the effect upon the sensorium with regard to a given idea is certainly more forcible and reliable if in addition to the vibratory register of the auditory apparatus, vision may send a message likewise to lend its weight to deepen the mental effect. Recognition on the part of the individual is much more satisfactory than when either one of these alone is to be depended upon. Therefore, illustration of any kind, whether by chart, picture, blackboard or in other form, is a powerful aid to strengthen the effect of the words of the lecturer.

The plan I follow in my lectures in the dental department of Milwaukee Medical College is intended to employ all of these various aids. The charts here shown are so prepared that each presents a skeleton of the lecture to be given.

The advantage of these is threefold. First, the student in taking notes can, with little difficulty, under each of the various headings given, write what is said regarding that particular portion of the subject, and, as the course proceeds, these notes will constitute a very valuable compend for future reference.

Second. Having the headings and classifications under his eye, the lecturer can easily follow in the order given, and thus avoid the danger of confusion through repetition. Moreover, charts prepared in this way, unlike written lectures, do not limit the scope of verbal illustrations, and before each lecture reference can be made to current literature, or it may be that a review of older writings may freshen the mind of the speaker and suggest new and valuable ideas.

Thus, no limit is placed upon the width or the breadth of his treatment of the subject from year to year, nor is it necessary to follow a single authority as when lessons are assigned.

Third, and last, if not least. During the hour the eyes of the student, fixed from time to time upon the clearly lettered chart, are unconsciously carrying home to each a mental picture that will doubtless remain a more or less clear image, associated with certain facts, to be easily recalled long after those committed by pure memory alone will have been forgotten.

When students become accustomed to a particular form of illustration it ceases to interest them in the same degree that it did in the beginning, or that some other kind of illustrating device would; therefore, variety is beneficial in this regard. I believe firmly that the time is well spent, in beginning a course, by giving up a goodly portion of the first hour to a discussion of what the work about to be considered really means.

In the first place, almost no one knows what is meant from the surgical point of view by the term *oral* surgery, brought into disrepute, as it has been in the eyes of general surgeons, by the attempting of too much by those who claim to practice it, and, on the other hand, belittled in medical eyes, and in view of the laity also, by narrowing the field of treatment to such conditions as almost every successful practitioner is capable of, and does treat every day in his office. Particularly where medical and dental students are associated together, it is imperative that this work should be distinctly outlined at the very outset.

Its scope, possibility and limitations clearly defined, and such encouragement given in the way of illustrations, as may tend to inspire high and lofty opinion of this surgical branch, so that all may understand in this field quite as much is to be accomplished for the benefit of humanity; quite as many new developments remain to be made as in any other branch of surgery, and that the future offers opportunities to the very fullest of ability of the most highly endowed individual.

Thus respect is engendered which must and does do much, as the course proceeds, to hold the attention and warrant the best efforts of the better class of students at least. It is failure to comprehend this simple fact that leads to difficulty in holding the attention and interest of the class, and doubtless for this very reason also it is true that medical men remain ignorant upon many things which they could learn to advantage from this very course simply because this significance has never been made clear to them in the medical school where they received instruction.

Having, then, given one hour to the consideration of pictures of cases we have treated, and of the most interesting ones that have been successfully treated by others, there still remains the advisability of at some future hour again impressing the fact of the far-reaching importance of the secrets that lie within the vestibule of the human body, the entrance to which is our special charge, its circulatory, nervous, lymphatic, muscular and other systems, and the dependence of their proper functions upon the condition of its parts.

The great passageway of the intestinal canal, and each and every organ connecting directly or indirectly therewith—the heart, the organs of sight and hearing, the brain and reason itself—each of these, while they may be dwelt on from time to time, and can be in a limited way during the teaching, must be grasped at one time in order that their full meaning as a whole may be appreciated by the student.

Therefore, I have prepared a lecture in which, by the aid of the stereopticon, all considerations are taken together and treated with regard to their relation to each other.

The influence of such a discussion reaches far beyond the confines of college walls, and must in time make itself felt upon the members of the community at large, and lead in a direction ultimately to bring those individuals who are in charge of institutions for the education of the young, and the care of public health, to a realization of the importance of the mouth as a factor in general disease and its care as a hygienic measure of public necessity.

By the use of the hand microscopes, which are here for your inspection, microscopical sections of tumors, histological, pathological or bacteriological specimens may be inspected to advantage. These, passed about the class, with slides relating to the subject under discussion, bring directly before the mind of each student interesting facts without loss of time, and to good advantage.

The microscopical attachment to the stereopticon enables them to be thrown upon the wall without the necessity of enlargement into regular lantern slides. Their advantage is that we have them shown in the colors that have resulted from the staining, in such manner as will enable them to be more intelligently described than when shown in black and white.

The virtues of the stereopticon cannot be overestimated. They are offset by the single disadvantage, perhaps, that during the lecture, whenever it is desired that the best effect may be given the class is comparatively in the dark, and there is difficulty on the part of the lecturer in giving and receiving that mutual understanding which undoubtedly accompanies a clear exchange of the message from his eyes to the eyes of his listeners, and back again. Occasionally, too, the question of discipline and order arises, because some member of the class may take this opportunity to disturb.

This, of course, is comparatively minor matter, and can be remedied in other ways.

The use of the blackboard by the lecturer himself is indispensable. Even though he be not an artist, any one can learn to describe, with the aid of a piece of chalk, that which he wishes to be understood. Where it is carried to the extreme of the artistic side, time is frequently expended which might be used to better advantage otherwise.

Moreover, it is not well for the one who addresses the class to turn his back when it can be avoided. Courtesy, at least, demands that he should face his audience, and usually there is some one who is ready to take advantage if his back is turned too often or too long. Rough outlines, however, can be drawn, and more or less ready flow of speech accompany them, so that each stroke can easily be described, and no unnecessary time need be lost.

Having a hospital in the same building with the college, it is possible in Milwaukee to bring cases into the lecture room from the hospital. Of course, clinical cases do not, as a rule, time themselves to particular lectures to be given on particular subjects, but still much can be done with a little care. As, for instance, it happened recently when we had four or more cases of fractured jaws. These cases were brought into the amphitheater, and the subject of fracture was taken up in detail, although out of its regular order in the course. So that the class was familiarized with certain facts which enabled them to understand the cases under treatment, and no repetition occurred, as would have been the case had the cases been described merely with reference to mode of procedure, and then lectured upon later under the title of the regular subject.

This cannot always be done, but when it can its advantages are many to the student. Students should be given the chance to see clinics, as well as to hear the lectures, otherwise they may remain utterly ignorant of the technic of surgical procedure in dealing with practical cases.

Of course, wherever it is possible, students should be allowed to assist in the operations and given opportunity to visit hospital cases, and to witness surgical operations of every nature.

Plaster of paris, the camera and written records should all be combined to preserve for future reference and use whatever may have been interesting or beneficial in the cases that have been treated from time to time by the class.

The what, the how, and the why, according to recent writers, form the basis of all teaching methods. Their significance can only be appreciated by a full understanding engendered through discussion between teacher and pupil. This can only be permitted without loss of discipline in the lecture room by some system of question and answer, therefore one should, whenever practical, allow a few minutes at the end of the hour, during which students may ask questions bearing directly upon the lecture just completed, for it is quite likely that what has been misunderstood by one student may not be clear to the others also, and the nature of the interrogations serve to guide lecturer with reference to the effect upon the class, of the lecture just concluded.

For a like reason it becomes necessary to question the students. In my own work it is my custom to do this in a variety of ways, and for several distinct purposes.

First. To arrest attention whenever a student's eye wanders, or he speaks to his neighbor, or gives other evidence of inattention, I try to fix his thoughts upon me instantly by some direct question—usually one that exposes to the class he has not been following my remarks. The result is instantaneous and beneficial.

Second. I ask questions at the beginning of the hour for the purpose of review, and for the opportunity to make clear portions of the subject that seem to be confused in the minds of the members of the class.

Third. To make students think and use their reasoning powers I am accustomed to ask questions that cannot be answered from the subject-matter of any lecture that may be given, but require conclusions that must be drawn by inference and thought.

It would be manifestly unfair to mark upon answers given upon such questions as the foregoing classes imply, therefore no record is taken.

Fourth. For examination purposes I give written and oral quiz examinations in which an effort is made to get at each individual's knowledge of each division of the subject as it is passed, his faithfulness and power of both verbal and written expression. In the formal quiz work, students are not required to stand, but in the oral quiz, upon which he is marked, each individual is required to rise and stand as he gives the answer.

Fifth. Final examination, which, in conjunction with marks given through the course, determine whether the advance to a higher grade shall be made, I prepare several hundred questions which cover, as far as possible, every aspect of the entire subject, and with the whole class present, give an oral examination that makes cribbing impossible, and has the great advantage of being the best drill that the class ever gets, because, with every faculty on the alert as answers are given, each student listens to a review of the whole subject from beginning to end, much of which will never be forgotten, and instead of being able to answer correctly a very limited number of questions, nearly every man will be able to pass upon nearly every one of several hundred essential facts.

DISCUSSION.

Dr. G. V. Black: Rather than let this go by default I will say a word. I am particularly pleased with the outline of the course in oral surgery. A number of years ago I went to Philadelphia, and was especially anxious to see Dr. Garretson operate. I was not particular about what the operation might be, but I wanted to see him operate. I found him exsecting a knee-joint. On the same day I found another man, not an oral surgeon, removing a portion of the lower jaw. My own notion is that we should confine the teaching of oral surgery in our schools very closely to those operations which the knowledge and experience gained in the practice of dentistry will facilitate; or, in other words, those operations which the dentist will be best prepared to perform. Now this depends, not upon his knowledge of pathology as the main factor; not upon his knowledge of disease in general; not upon his knowledge of physiology; not upon his knowledge of histology—we all should have those things—but upon the deftness of his fingers in doing particular things. Take the divisions in medical practice, or the divisions in surgical practice, or the divisions into specialties in the healing art; upon what are they based? Not upon the knowledge of anatomy, histology, physiology, etc., these are the basic principle for us all. They are based almost exclusively upon manipulative procedures. The one may choose the eye; he trains his fingers, he trains his thought particularly upon the eye, its tissues, the methods of cutting, the methods of handling, the methods of examination, if you please, of that particular organ, and the lesions of that organ; of the ear, we may say the same thing; of skin diseases we may say the same thing; of diseases of the lungs, the auscultation, the manipulations of diagnoses, the training of the ear to the sounds of the lungs in breathing, all these come in for this particular class of manipulative procedures. So we might go on through all the specialties of medicine. They are not based upon a man's knowledge of pathology, physiology, etc., but upon certain manipulative procedures, either in the operative branch or in the diagnostic. There are manipulative reasons, then, for these divisions in medicine or in surgery, and the divisions that are coming up in dentistry. They are manipulative in character.

Now for the dental student, I should say, we should teach them particularly those operations which their habit and practice, acquired in dentistry, render them best able to perform—those operations in the mouth and immediately about the mouth—the tissues that they have learned particularly to handle. A number of years ago I should have included a wider scope in surgery; I should have included operations on the lips particularly and other operations about the face—I should hardly be inclined to do so to-day. Possibly our operations render us better able to handle the lips—to remove cancer of the lips, for instance, but not so particularly so. I have cut a good many of these from time to time myself, but I do not see but the general surgeon can do that about as well as the dentist, but when it comes to a removal of portions of the facial nerves, especially of the third branch, I doubt whether the general surgeon can do it so well. There are certain manipulative procedures that the dentist is accustomed to in this region that will enable him, in many operations, especially those that are appropriate within the mouth, to do with greater facility than the general surgeon could be expected to do; for that reason it falls naturally in the province of the oral surgeon; so do very many affections of the mouth, operations of the antrum, cleft palate, etc. Now these are the classes of cases, then, that I should include in a series of lectures upon oral surgery. Of course the general principles of surgery are important; they must be taught to any class that undertakes surgery of any kind, but they are not especially for dental students any more than for medical students--that is general, and applies to surgery everywhere. The knowledge of disease, the knowledge of tumors, the knowledge of conditions, that have been given here, belong to the general surgeon just as much as to the oral surgeon. The differences are not based upon these, but based upon finger skill and that which comes from being accustomed to operating in this peculiar region. I remember that when a boy in this work, and in years as well, a surgeon said to me—it was one of the first cases in which I was called to operate upon a very serious fracture of the lower jaw. Says he: "These cases of fractures of the jaws are the most troublesome surgery I have anything to do with." I saw very plainly that he had not had that experience in handling these fractures of the jaws that he had had in the handling of other fractures. He had not had the practice in handling the mouth that I had had, although I was comparatively inexperienced at that time; and that was one reason why he had more trouble with this than other classes of fractures. Another reason was that he was unable to construct the proper appliances.

We can attend to these fractures easier than the surgeon, because it is our field of work and our fingers have been trained to the handling of these particular tissues. I don't know how many dentists ought to undertake the treatment of fractures of the jaws, but those who practice in country districts, or in the smaller towns, will be called upon more frequently than those who practice in the larger cities, and it seems to me that every one of them should be able to take hold of these cases, to handle them for the surgeon, or to handle them in connection with the surgeon. They should be able to take hold of them and handle them on their own responsibility if necessary. I had to do it, whether I wanted to or not, where I got no pay for it, because it happens that those people who get their jaws broken are often not the people that have money, and yet they must have attention from somebody. Sometimes they do have money.

Let me tell you a little story. I was called to go some seventy-five or eighty miles away to treat a fracture of the jaw. I threw together what things I could and took the train. When I arrived at the town I met parties with a wagon, who said it was six miles in the country. When I arrived at the farmhouse at eight o'clock at night I found a very large fat Dutchman with the lower jaw broken in four pieces, with the upper teeth knocked out, by a blow he had received, all but one or two, and they were too loose to be of any use. The wound was two days old; there was immense swelling of the parts, the soft tissues were cut through in a number of places. The injury had been done by a wheel used in raising hay into the barn, that had broken loose and struck him in the face. It was night time, and the light was tallow dips. Well, some of you who have seen this class of cases can imagine the possibilities that were presented. But at four o'clock in the morning the old gentleman went to the looking glass and looked himself over and said he thought it would do, and I went home. Now such a thing may occur to our students at any time, and they need to have that instruction that will give them the courage to take hold of even such a case as that and put it in shape; and to do so, they will often have to use a good deal of invention. I had nothing to make a splint of except some gutta-percha, yet I made a splint, using a piece of telegraph wire to stiffen it, and tied it on to that jaw with silver wire passed around each fragment of bone, wiring the pieces of bone to the splint in that way.

Now this kind of invention must be brought out in the teaching of oral surgery, together with the instruction in lectures and the instruction given in clinics, the invention brought out by the classes of cases that happen to be presented, and the variation that may be pictured from the cases that come before the class; and in all these ways this inventive genius must be aroused in students so that they will be enabled to take hold of these cases and do them, and do them well.

A case came into our school a few days ago, in which there had been a fracture of the jaw upon one side four or five years ago. The patient came in with a fracture upon the other side that had just occurred. Our surgeon spoke to the class at once, and said: If any of you treat a case of fracture as this old fracture was treated, and should be sued for malpractice, do not come to me as an expert witness. If you do, I shall say at once to the court and the jury that you have not done your duty. The occlusion of the teeth was so bad that when the jaws were closed I could pass my fingers between the molars upon the one side. Now we do not want our students to do surgical operations in such a way. They would be fit subjects for punishment for malpractice if they did.

Dr. N. S. Hoff: Mr. President, I do not want my reputation injured. Dr. Black talked longer than I ever did. He talked so well he has fired me to say something. When Dr. Brophy went home to-night he made me promise that I would talk for him on this subject.

I want to tell you how we teach oral surgery in the University of Michigan. Our oral surgery is taught first by the lecture plan. We have for a teacher the assistant surgeon in the medical department, a very excellent and capable man. He takes a great deal of interest in this work, and presents it as well as he can by the lecture plan. He teaches the general principles of surgery, to begin with; and confines himself, as nearly as he can, to oral surgery, and the surgery of the face and the adjoining structures. He brings such cases as he can before the class. All cases of dental interest which appear in the hospital he gets the privilege of exhibiting to the dental class before they are operated upon, and when these operations are made in the hospital the dental students go to see them. He gives anæsthetics before the class, he examines the patients before he gives the anæsthetics; and does all that he can in illustrating his work in that way. But he is not satisfied with that; and he has suggested that we adopt the plan that is carried out in connection with the teaching of general surgery in the medical department; that is, to have what is called a demonstration course. Sections of the students are taken into the surgical laboratory, where they make all sorts of operations upon the cadaver. Our surgeon has found that the part of the cadaver which is most neglected by medical students is that part which the dental students most need, and he has secured the privilege of reserving the head and the face—particularly the face, mouth and the adjacent tissues—for the dental students.

The class is divided into sections of from ten to twelve, and they are required to make such operations as the demonstrator shall indicate on the cadaver. We cannot make it a compulsory matter for this year, but almost the entire membership of the senior class has signified a desire to take the course. We are doing it largely this year as an experiment, with the expectation next year of making it a permanent feature of the work, and a requirement in the course. Our surgeon proposes to make all operations upon the cadaver that the dentist would be likely to be called upon to make: operations upon the antrum; operations upon the face, and upon the tissues of the face; operations upon the nerve; operations upon the contiguous portions of the mouth—of every kind that it is possible to devise, and have the students make them themselves on the cadavers. And this idea is also to make fractures of the jaws, and have the students make splints for them. We propose to secure microscopic and lantern slides of tumors from the surgical clinic for the students to study in connection with this course. I have suggested already to him that the lantern slides of the sections made by Dr. Cryer would be very helpful, and we expect to get those slides, so that we may use them in exhibiting the work with the lantern. We also intend to prepare, if we can get the material, wet anatomical specimens; and if we cannot get the material ourselves, to send abroad where such things are prepared, to make this work of teaching oral surgery such that the students will comprehend it more clearly than they can from the lecture course only. It is impossible, of course, to get in a clinic such work for students to do, but we think possibly the students can learn the principles of making these operations upon the cadaver, if not on the living subject. We are just organizing this method of presenting this subject and if any one has done anything of this kind, or has any suggestion to make about it, I should be very glad to hear from him. We want to make it as practical and useful a demonstration course as possible. I do not know that any of you do your work in that way, or have any such work in connection with your schools.

Dr. G. V. I. Brown: I want to call attention to just one or two things that have been suggested. What Dr. Black said with regard to cases that fell into our hands I have found to be properly ours, and the surgeons are mighty glad to get rid of these cases when they can. For instance, we had the other day four cases of fracture at one time, and three of these were almost beyond the possibility of doing anything with, because they had gone on so hopelessly from month to month that a union was impossible for weeks, and one a case where the superior maxillary had been fractured into a number of pieces. (The patient had been thrown down by a runaway horse.) The surgeon brought the patient to me after several months had elapsed for diagnosis and treatment. The patient could not get his mouth shut—you could put your finger in between his front teeth—the entire arch was destroyed—and only by orthodontia methods could the fracture be reduced.

Dr. Black's work is certainly of great benefit. I have no doubt that it will be a howling success.

Before I close I would like to speak of one more thing: that is, the association of these cases. I was able the other day to have four cases of cleft palate to show to the class at one time, each one requiring a different kind of an operation, and each one in a class by itself. One was a child, newly born, a few weeks old, that required an immediate operation, such as Dr. Brophy would perform, in order to keep it alive; the other one was a child a number of months old—too old for that operation, still within the possibility of having an operation in time to have it speak without the usual unfortunate sound. The other was a grown man, all of these three congenital—and one that was acquired in syphilis. When you can take your patients before your class in that way, show them the actual cases and let them understand the relation of those cases to each other, it seems to me they get the idea pretty closely.

NEW FEATURES IN THE TEACHING OF DENTAL ANATOMY AND DENTAL TECHNICS.

By A. E. Webster, M. D., D. D. S., L. D. S., Toronto, Can.

When I presented the flexible rubber tooth form before this society two years ago all agreed that to place the teeth in a flexible base was a good idea. At that time, and even now, I am asked if these forms will be put on the market so that students may buy them. It is the desire to-day to show why each student should make his own tooth form. The former plan of carving the teeth in compound, reproducing these in gray vulcanite, and then recarving and polishing them was a good deal of trouble, but the student got a good training in tooth form. The present plan of carving the teeth out of white celluloid shortens the work considerably, besides increasing the range of usefulness of the form when completed.

Begin every new subject with what is familiar to the student; so in dental anatomy, as a first exercise, have students examine each others' mouths and teeth. The important parts of the mouth and their relations should be made out. The markings on plaster casts of the mouth should be compared with those in the mouth. The bones of the jaws are examined in conjunction with plaster casts and the oral cavity. The relation of the teeth to other parts is studied in a general way, thus laying the foundation for a more minute study later. From the skull and plaster casts is studied the general arrangement of the teeth, their occlusion and attachment to the bones, the classes of teeth (incisors, bicuspids and molars) and their surfaces. When we say that the student studies from plaster casts, skulls and oral cavity, we mean that each man has before him a cast, a skull and a mouth, and the parts are discussed together, the teacher drawing attention to the part he wishes examined, while the student describes what he sees or feels.

Centrals, laterals and cuspids are all studied together from large models, charts, drawings and the natural teeth. All are wedge-shaped, single-rooted, wide mesio-distally, narrow, labio-lingually; representing a general class, and should be studied together. The upper central incisor for minute study is divided into root and crown.

Exact relative measurements are made, e. g.—root and crown—mesio-distal at morsal surface and at the neck—labio-lingual at morsal surface and at the neck. Diagonal measurements from mesio-occlusal to disto-gingival and disto-occlusal and mesio-gingival. Width of labial surface at several points, as compared with lingual at the same points. A tooth may be rapidly modeled up from clay before the class, to show the form of the different surfaces. The students with the teeth in their hands decide the relative measurements mentioned. When there are differences in the teeth held by the students, the question is put to vote, which will give a very good idea of the prevailing size or form. Now a demonstration is given on carving in hard plaster of paris, measurements by calipers in plaster carvings, and as soon as each student shows by his carvings of this material that he has grasped the general idea of the form of the tooth, he is given a rod of white celluloid seven-sixteenths of an inch in diameter, on one end of which he carves a central incisor. A demonstration as to how to work celluloid is made before the student begins to carve this material. At this time the student selects a natural central incisor tooth as a type in size and form that must be followed throughout—plaster casts of fellow students' teeth or those from a skull are used in making a selection of a full set of teeth that will harmonize with the central taken as a type.

The differences between the lateral and central are studied from large models, drawings and the natural teeth. The student then carves the lateral from his selected type. The cuspid is studied and carved in the same way. The bicuspids are studied in general and then in particular, and so with the molars. The celluloid for molars should be nine-sixteenths of an inch in diameter. As soon as a student has carved a set of fourteen upper teeth he begins to think of how his particular type of teeth ought to be arranged to give the most natural appearance. Again he appeals to plaster casts, class-mates' teeth and the teeth in skulls, while at this time the teacher is pointing out the general forms from plaster models, charts, lantern slides, etc. In the presence of a number of plaster casts, models, lantern slides and students' mouths, a good general idea of normal arrangement and occlusion may be gained.

The fourteen carved teeth are set up in a block of beeswax, small enough to fit comfortably inside of an ordinary dental flask. A minute study of the soft parts of the mouth is made with as much care as the arrangement of the teeth, using the same aids and using just as much care in the harmony of the parts. The rugæ, palate and eminences of the roots, etc., are carefully carved out in the wax, and must be in perfect harmony with the size and form of the teeth and their arrangement. When completed the block of wax containing the teeth is invested in the flask—separated—wax removed—and in its place is packed a rubber that will vulcanize in about twenty minutes at 250 F. This rubber must be flexible when vulcanized and yet rigid enough to hold the teeth in position while being worked upon. The rubber may be obtained from any rubber factory at about fifty cents a pound. A pink colored rubber may be obtained, if desired. A more flexible rubber may be placed around the necks of the teeth than that which makes up the main body of the form, thus giving rigidity and flexibility just where they are desired. Previous to setting up the teeth in the wax cavities may be cut in them, which will allow the teeth to come close together, and if wax be allowed to enter these cavities it will be replaced by rubber, which will present many of the difficulties of removal found in gum tissue similarly placed. The whole cost of this tooth form is about forty-three cents.

A general study of the tooth tissues is made from sections cut of the different teeth—longitudinal—and at least three cross-sections of each tooth. Altogether, the class identifies the enamel, dentin, cementum and pulp chamber. If the student knows the external anatomy of the teeth and arrives at the conclusion that the pulp chamber is of the same general form, not very much time need be spent on this part of the subject. Careful drawings are made, showing enamel, dentin, cementum and pulp chambers of the sections cut. In drawings presented the histological structure indicated is that obtained from the chair of histology.

If a student can make fairly good drawings of the teeth and of the different sections and tissues and carve fourteen such teeth as I present to you and form the soft tissues of the mouth and arrange the teeth according to the type he has selected, there is not much question as to his knowledge of form in general and dental anatomy in particular. A student will never make a better drawing or carving than he knows, but he may write down a great deal that is mere information and not knowledge at all.

Dental anatomy should complete the technical work of the freshman year, leaving operative technic for the second year. In most dental colleges—and I am sorry to say it is true in the college with which I have the honor to be connected—operative technic is completed in the first year. The student with us never enters the infirmary before January of the second year, thus it is, he has not an opportunity to put into practice or review his technic knowledge or handicraft for almost a year after it is learned, while in some schools it is a year and a half from the time he completes operative technic until he enters the infirmary. I am sure every man here has noticed the awkwardness of his own fingers after a holiday of a month or so. If this be the case with men who have been in practice for years, think of the condition of the student after eighteen months' absence from a work in which he only had at best but a poor training. Operative technic should properly begin about two months or so previous to the student's entrance to the infirmary and run concurrently with the infirmary practice for at least a month. The student could apply his technic to infirmary work before mind and hand have lost their cunning. If the student should meet a case in the infirmary that he is not very sure how to proceed with, he may perform the operation on the tooth form or on natural teeth previous to the next visit of his patient. In this way both the time of the patient and student are saved, and mistakes which would be irremediable in the mouth may be made and corrected in the technic room.

One of the most serious objections in the mind of some teachers to the study of anatomy in the manner here presented is the time it takes. Several teachers have said to me that this carving would be a good thing if we had a four years' course, but I say it is a good thing now, or at any time, because it is the most natural and therefore the most rapid manner in which any one can learn dental anatomy. In proof of this I wish to present to you the work done by our students this term. I wish you to be the examiners and decide whether the students who have done this work know their dental anatomy or not. I wish to show you samples of work done in our technic room for the past three years. Note the product—this year's work was done in half the time of last year's and one-third of the time of the year before. The ability of the students is about the same, the difference is in the manner of teaching. We have a class of sixty-eight students, divided into two sections, each section works two and one-quarter hours every other day in the week except Saturdays. The work shown you represents about twenty-five days work of two and one-quarter hours each, or in all sixty hours. There are few teachers who spend less time on dental anatomy than this.

The committee of this society on the syllabus for operative technic recommends tooth carving, but some will say, Why do carving at all? To such we reply, for two reasons: First, for its educational value, and second, for the usefulness of the knowledge obtained. Carving educates the perception, the acquisition, the memory and reproduction or expression of knowledge. It educates the co-ordination of the hand and mind.

In porcelain crown and bridge work it is essential that the dentist should know the form of a tooth in order to build up the body before baking. In contour inlays a perfect knowledge of tooth form is necessary. In gold crown and bridge work a perfect occlusion is only obtained when the natural forms and conditions are known. In filling teeth the exact form and location of the contact points are essential to get the best results from such operations. In crown, bridge and plate work the dentist should know the normal arrangement of the teeth and their harmonious relations in size and form, and besides he should know the form and relations of the soft tissues of the mouth.

It would seem that to carve the teeth from celluloid and the gums, rugæ and palate from wax gives the best mental and manual training for the time spent upon it. Celluloid is cheap and of the proper color and is easily stained. It is tough and hard, and will take a good polish; it can be moulded to whatever form desired and will bear without deterioration a temperature sufficient to vulcanize flexible rubber about the roots of the teeth. Next year we hope to see blocks of celluloid somewhat of the *form* of the teeth on sale by the depots. In clay modeling *form* is all that can be learned by the student of dentistry that will be afterward useful to him. The material and instruments used and size of the teeth made are all different from anything he will ever use or need in dentistry. The same objection may be urged against carving in soap. Ivory and bone are so hard that the student loses all interest in the work before he gets it cut down to the point where he is thinking of tooth form at all.

Before leaving the subject of dental anatomy I wish to call attention to the strict adherence to the principles of psychology in teaching the subject as has been outlined. "Proceed from the known or familiar to the unknown," e. g., pupils examine each others' mouths, then models and bones. "Proceed from the general to the particular," e. g., study all the teeth, then classes, then individuals, the whole tooth, then its surfaces." "Appeal to as many of the senses as possible," e. g., *sight*, the large models, drawings, pictures, natural teeth and carvings done in the presence of pupils; *hearing*, the teacher directing attention to certain parts. *Feeling*. As Liberty Tadd said to us last year: "We feel form, we don't see it." The student models, carves and draws the forms, he feels, sees and hears described. "Learn to do by doing." "Practical exercises previous to or concurrently with theory," so-called. "Never theory first and practical exercise last," e. g., no lectures on the development of the teeth until the student has at least seen the teeth and identified their relations to the jaws. "Teach facts by the laws of association," e. g., likenesses and differences between the central and lateral. The main difference beween the trained mind and the untrained is one of classification. The untrained mind remembers each fact while the trained remembers only principles, and by working on these the details and facts in connection with them are thought out by the laws of association. In teaching dentistry the grouping of facts around the principles or classes laid down will put the minds of the students in their natural channels, thereby greatly assisting memory, e. g., it is just as easy to remember that all the buccal and labial surfaces of the teeth are convex as to remember that the labial surface of the central is convex, but note how much more knowledge or information there is in knowing the one than the other.

In teaching operative technics the tooth form is almost indispensable. The rubber dam is applied under almost the same circumstances as in the mouth. The size of piece, the size and arrangement of the holes, inverting the edges of the holes under the free margins of the gums, tying of ligatures, application of cervical clamps, rubber dam clamps, clamp forceps, are all well exemplified in the form. After an exercise on the form, the student should be required to apply the rubber dam to his partner's teeth in at least two locations.

Every possible appliance for the separating of teeth, for filling proximate cavities can be studied. The slow means of getting space works admirably. If wedges be placed between the teeth and allowed to remain for some time, space is gained which will be but slowly closed up on removing the wedge. Immediate separation is beautifully illustrated, the teeth coming back to their original positions immediately or slowly, according to the time and distance they have been kept apart. Careless or improper use of the separator will result in fracture of the teeth or destruction of the soft rubber about the necks of the teeth. When cavities have been cut upon the proximate surfaces previous to setting up the teeth and the teeth allowed to approximate each other closely and these cavities become filled with soft rubber, the conditions and difficulties of getting space and getting the rubber out of the cavities and getting the rubber dam in position are quite similar to those met with in the mouth.

Grasp and rest practice on the form is very similar to such practice in the mouth. The place in the cavity for the use of each instrument makes good practice. The classification of cavities and cavity nomenclature are as easily learned while the student is preparing cavities in the teeth, as the names of the carpenter's tools are learned by his apprentice. The student learns the use of the chisel, the hatchet, the hoe and the burr. The celluloid cuts clean, hard and tough, is resistant and leaves a good clean decisive hard margin. If the student has seen and examined a sufficient number of decayed teeth for him to have arrived at a conclusion as to the usual locations of caries, he will appreciate what is meant by "extension for prevention" and cutting fissures out to their ends. When a student prepares a proximate cavity, fills it and polishes the filling, removes the separator and rubber dam he sees for himself if proper extension has been made, if the contact point is in the proper location and of the proper size, he sees if the interproximate space has been preserved or not, and the gum properly protected. Compare the advantage to the student of preparing a cavity in a tooth while it is in its relation to all the other teeth with doing a similar operation in a tooth separated from its associates. The seating of fillings and the lines of force are better understood when they are studied with the teeth in proper relation. At this point I wish to make a strong plea for the teaching of dental engine technic. When, where and how to use the engine is more essential to the safety of the patient in the dental infirmary than all the long-winded lectures that have ever been given on the pros and cons of gold and amalgam. Why is it that the student must learn all about the grasps and rests of the chisel before he may work on a patient's teeth, yet he is supposed to know by instinct how to grasp the engine handpiece, no matter if it hold a stone, a burr, a disk or even a saw? Every student should have a dental engine before he enters the infirmary, and if his operative technic is running concurrently with infirmary work, for a month or so, there is no good reason why the cavities in the tooth form should not be prepared with the burr where its use is indicated. As a rule, every student taken into the infirmary for the first time will expose more pulps with his new engine and sharp burrs in the first few days than he will in the whole of the remaining time he is in the infirmary. The reason for this is that the student, first, does not know when the burr ought to be used, and, second, he cannot control the handpiece. Fillings should be finished in the technic room with the same instruments as in the mouth. Any undue roughness or improper use of files, burrs, stones, disks or strips will show itself on the soft rubber about the necks of the teeth or on the teeth themselves. In no better way can the student study the use and limitations of the different forms of matrices than on the tooth form.

Every kind of filling material may be packed into the cavities prepared in the teeth with the same instruments as in the mouth.

Usually in crown and bridge work technic, the student makes a crown of any size, shape or shade of porcelain, and grinds the root of a natural tooth to fit the band. How much better would the student know the procedures in making a crown for the mouth if he had cut, say, the central incisor, off the tooth form, drilled out the root canal, trimmed the root, fitted band post and cap, selected facing, proper shade, shape and size, ground it up, took impression, invested and soldered the crown, finished and set it. There is no comparison between the two methods for teaching crown technics. The same may be said of bridge work technics. I wish to lay stress upon the opportunities given for the study of a proper selection of teeth in crowns and bridges.

At this time I shall not take up orthodontia technic, but merely show how admirably adapted it is to this class of technic work.

In the study of root canal fillings and the different materials used for the purpose I wish to call attention to the advantages of having each student fill glass tubes the size and shape of the roots of teeth as a first exercise. The perfectness of these fillings may be seen and tested by immersing the fine ends of the tubes into some coloring fluid. After the student has learned by experiment the best way to fill a canal he is expected to fill the root canals of several teeth and later files the teeth down so as to expose the root filling.

In closing, attention is directed to these new features, viz.:

1. The strict adherence to the psychological principles of teaching, as subject is here presented.
2. The harmony of the teeth to each other, to arrangement and to the soft tissues.
3. Carving of the teeth from white celluloid.
4. Implanting these in pink flexible rubber.
5. Usefulness of the form in teaching crown and bridge technics.
6. Usefulness of the form in teaching porcelain inlay technic.
7. Usefulness of the form in teaching operative technics and orthodontia.
8. The teaching of dental engine technics.
9. The teaching of operative technics immediately before and concurrently with infirmary practice.
10. The teaching of comparative merits of root canal filling, materials experimentally in glass tubes whose small ends are afterward immersed in a coloring fluid.

DISCUSSION.

Dr. G. V. Black: I must say that I am very much gratified to have listened to this presentation, and I do not think I want to discuss it especially.

Some thoughts have come overy my mind this evening while listening to this and looking over these forms, that may seem to some of you to be strange. Here is a piece of carving, for instance, done by a freshman student, and some of you may think it strange if I say to you that there is not a picture in existence made before technic work was begun that compares with it in correctness of the occlusal surfaces of the teeth. Now some of you may not have noted that; but if you will go back over the pages of the *Cosmos* or any other of our journals, or over the pages of the text-books published prior to that time, and study the pictures of the occlusal surfaces of teeth you will find that what I say is true. You may compare them with most of these, and you will be compelled to say that these carvings are better representations of the form of the occlusal surfaces of natural teeth than anything you will find in the illustrations. Yet, to-day we have abundance of good and correct representations of the occlusal surfaces of the teeth in the illustrations in our magazines and in our books. Why? We have begun studying these things, but we have not reached the limit. In each one of these as I take them up I see errors; they are incorrect, not a one of them correct; but they approach correctness very closely; and considering that they are carvings made by freshmen students they are fine, they are splendid. And the doctor has spoken of the fact that three years ago it took his class longer and last year it took less time, and this last year it took only half the time of the year before. The students were not different, but the teacher was. There is where the principal point comes. Others who have had their students carve teeth have found that their first class did not do it as well nor as quickly as the second, and the third classes would do it still better, and so on. The teacher knew better how to instruct the student. We are growing in this work continually, and these new tooth forms, made in this way, is another of the additions, another of these growths that are cropping out. It is gratifying to see these growths.

Now as to the comparative merits of carving in this celluloid—and it is beautiful carving, it is a beautiful material—and carving in ivory there is some question. The celluloid is much easier carved; the student can carve more forms in the same time; he can study more forms in the same time; and in that there is very decided merit. But the material is different from that in which he will use his instruments later. He does not get manipulation that will have the same benefit in the training of his fingers for future work in the mouth on the natural teeth that he would get from carving bone or ivory. Time and experience will tell.

I must say that I am greatly pleased with these forms, the facility with which they may be put together and the uses that are being made of the forms.

Now as to the natural methods of teaching, I would like to say one word, for I think there are a great many errors among teachers as to that. I think Dr. Webster has been correct in what he has stated in regard to that, and I would like to call attention to it in the matter of teaching nomenclature. It would be very well if the student did not find out that the man who was teaching nomenclature was at that business at all—teaching the names of the teeth. "This is the incisor, why is it called the incisor? Because it is to cut with." Well, that, perhaps is not teaching nomenclature, yet it is. Go on with all the rest in the same way. That is, do not teach nomenclature, but teach things, and give those things their proper names, explaining the reasons for the name when necessary. That is all there is to teaching nomenclature. And do not call the same thing by two names. I dislike that very much; the students become mixed up when you do that. There has been a wonderful improvement in the use of the terms by the dental profession within a very few years. We go back to the books written ten to twenty years ago, and compare them with the books that are being written now, and notice the nomenclature, and we will find that there has been a great improvement. Many of you do not feel that there has been such a great improvement, but if you will go back and read books or journals from page to page, and note the words used, you will soon appreciate that there is a difference, and it is a difference that is of great advantage to our students. Then I will say follow the natural method; go from that which the student knows to that which he does not know. Let every comparison go immediately back to the subject which the student does know; in nomenclature; in form; in things, and all of that.

G. Walter Dittmar, D. D. S., Chicago, Ill.: Some of these new features in teaching dental anatomy and technics are truly *new to me*, i. e., I have never used them. However, in Chicago, where we rather pride ourselves on giving, what we think, good courses in this subject, we have for some time been using many of the means mentioned.

By the way, we use Black's Dental Anatomy as a text-book, and charts, drawings, models, skulls and extracted teeth to assist us.

Carefully study the physical and anatomical divisions of teeth, dissect teeth longitudinally and transversely. Classify and properly arrange them in sets, make drawings and also *carve*, using natural extracted teeth as models. The latter, i. e., *carving*, I believe with Dr. Webster, to be one of the most efficient methods, to impress dental anatomy upon the mind of the student, and at the same time develop manual training.

Besides the more accurate knowledge attained of tooth form, it develops dexterity and precision with the fingers and carefully trains the eye.

At our college we have never used celluloid for carvings. Yet I know of no reason why it is not a good substance to use for this purpose. However, I do not consider the objections the essayist advanced against the use of ivory as based just right. I do not think that on account of its hardness the student loses interest in his work before he gets it cut down to resemble a tooth. The fact is, that after he has outlined on his ivory block what he wishes, with a pencil or a pointed instrument, with a mechanical saw and a file, he in a few minutes has roughly the form sought, then with scrapers, chisels, spoons, hoes, etc., he soon works it down to the desired form. Its hardness to work is, if anything, an advantage—if finger training is one of the essential points sought, *and it certainly is.* Then also its physical make-up and consistency are very much the same as dentin. The essayist spoke of using a central incisor as a type, then taking an impression and getting a *cast* with teeth harmonizing with the extracted central and use this cast as a model for the carvings to be made.

Now, providing he uses in conjunction with this model, natural extracted teeth also, I can see the advantage of getting carvings whose crowns at least will harmonize, but unless extracted teeth are also used as models the student forms no accurate conception of the roots of the teeth, a knowledge of which is almost as essential as is that of the forms of the crowns.

I come now to what I will concede to Dr. Webster as the principal "*new feature* in teaching dental anatomy and technics," and that is to have the student make the "form so aptly described by the essayist."

I think this a most excellent idea. It certainly is a decided step taken in the right direction, and deserving of much commendation. Allow me to suggest, however, the vulcanizing of extracted teeth and roots into the "form" for the purpose of applying the technique of treating teeth, pulp canals, abscesses and finally filling the roots. Then, if desired, the adjusting of crowns and bridges.

The psychological principles pointed out by the essayist are unquestionably sound and should be closely followed by instructors. It is certainly only rational to proceed from the familiar or known to the unknown, from the general to the particular, and to teach by association and comparison.

If our colleges required a four-year course I would heartily endorse Dr. Webster's statement: "That dental anatomy should complete the technic work for the freshman year, leaving operative technic for the second."

However, as we now have it, it seems to me that it is necessary to commence operative technic about the middle of the first year.

In the school with which I am associated we do not keep the student out of the operatory until the middle of the second year, BUT about the last month of the first year, the freshman is allowed to do minor operations in the mouth. And he certainly is more competent at that time than at the middle of the second year, unless, as the essayist suggests, operative technic is taught concurrently with the first few months of the student's operatory work.

This latter, I think, should be done any way. Operative technic work should be graded, and in the second grade, commencing a short time before and running concurrently with work in the operatory is when instrumentation, dental engine technics, grasps, rests, adjusting of the rubber dam, clamps, separator, etc., should be taught.

Just a few words more. A technical term used by the essayist that I do not like and for the use of which I can see no good reason. The word "*morsal.*" I should have used *incisal.*

However, on the whole, I wish to personally sincerely thank Dr. Webster for his most excellent paper. I have profited much from it and the discussion it produced. I believe we all have learned something. I confess I have learned much. He truly can be credited with presenting some New Features in Teaching Dental Anatomy and Dental Technics.

Dr. L. S. Tenney, Chicago, Ill.: While I very gladly consented to say something on this paper, I know at this late hour you will thank me for not prolonging the discussion. I certainly wish to praise Dr. Webster for his paper and for his work. Like every good thing that he has ever presented us, it is bright, new, original, and well worthy of its distinguished author. I agree with Dr. Peck, that we sometimes fall into the error of commending every paper that is presented to us, out of courtesy to our essayists, but certainly there is nothing in this one that any of us could take the slightest exception to. I refer with no little satisfaction and pride to the fact that Dr. Webster was a student of mine, and I am very glad indeed to see him showing so many evidences of his early training. I always knew when I saw him sitting on one of those easy upholstered stools in front of the long benches, that there was within him a latent force that would sooner or later develop into the very talents that he has displayed on so many occasions before this body. Now if Dr. Webster is satisfied with the compliments I have paid him—and incidentally paid myself—I will make just one or two remarks on this paper.

That these subjects are brought far better within the comprehension of the student by such methods as these than by purely didactic instruction has long since become an established fact, and will not admit of argument. It has been said by some one that hearing excites curiosity; seeing satisfies it; and when I note the intense interest with which a class of students witnesses a mechanical operation or demonstration of any kind, and the apparent listlessness with which they frequently will greet the most accomplished and interesting lecturer, I am persuaded that the demonstration method should in a large measure supplant all others. In regard to this particular method, and that is the only thing I am going to speak of, because I do not want to go into details at this hour, in regard to the use of celluloid in carving tooth forms, which has been freely discussed yesterday and to-night, it is agreed, I believe, by those who have used it and those who have not, that it is a most useful addition to our teaching methods. But gentlemen, I, for one, am not yet persuaded that this should take the place of our ivory carving. I suppose we are all prone to follow along beaten paths, but I have met with such gratifying results—gratifying to myself and gratifying to my students, with the ivory work, that I am loath to give it up. Some one has said that the carving of celluloid is much easier than that of ivory, and, therefore, a point in its favor. Gentlemen, that is the very ground of my objection. I like ivory because of the difficulty of the work and because of the painstaking labor that is involved. The student carries the carving of the ivory right along with his other work and other demonstrations, and I submit to you that by the time a man has taken a block of ivory and a molar tooth, and has by the most careful, painstaking and diligent effort, carved its fossæ, fissures and ridges, pits and grooves, and the contour of all of its surfaces, he has an impression of that tooth fixed in his mind indelibly and forever.

What we want, in my opinion, is to have a form like this, made easily, quickly and placed within the reach of all our students, upon which to demonstrate our cavity preparation and filling operations, but we should not discard the ivory carving.

Dr. Kenyon: This topic is one which I am very much interested in, as this is my first year in teaching operative technic, and I have learned a great many things I did not know before.

In our college we have arranged to have the students pass from their operative technic work to the operating room. They are required to finish completely the operative technic work, and we expect they will go immediately at that time into the operating room and begin to work in the clinical practice.

I wish to commend the courage with which Dr. Webster has advocated engine technic. When I was a student in operative technic I commenced to inquire why I could not have a chance to learn to use my engine on teeth outside of the mouth. Now I don't want any one to misunderstand me. I don't want the student to use his engine in his work when he should be training his hands in the use of excavating instruments, and I do not allow it in my work, but if the student has done a sufficient amount of work by the hand method, entirely for hand training, why he could not have a little training in the use of his engine, I cannot see. Every time I broached that subject to any of our professors I was discouraged, but I never yet have received an answer that convinced me that it would not be a good thing. I was told that operative technic was conceived with the idea of training the hand, and that the use of the engine at all would be out of place in the work. I ask the question, Why doesn't the hand need a little training at least in handling the burr? There is no instrument so prone to jump or slip as a burr revolving at a high speed. There is no instrument we use that is liable to do the damage in the mouth that the surgical engine will do if it is lost control of in the operation. I believe, with Dr. Webster, that the student ought to have at least a little training at the end of the course. I cannot see why engine technic should not be taught just as well as hand technic; it is hand technic applied with a different sort of an instrument; I cannot see it in any other way, and I cannot be convinced that a little of it is not the proper thing at the proper time in the course.

DR. WEBSTER: In closing the discussion I wish to thank Dr. Snow, of the Buffalo Dental College, for the suggestion in carving in celluloid, and I want to close the discussion by showing you something. It is more or less imperfect. It is an idea of Dr. Charles Pearson, of Toronto, for teaching orthodontia, or prosthetic dentistry, if you desire. We hope some time it will be perfected so that it may be used as a model or a chart for teaching. Dr. Pearson used it for demonstration—the first time before, I think, a social entertainment—a children's entertainment—for making various pictures—little monkey faces, as suggested. Since that time, we have developed it a little bit more, and we have as many noses and upper lips as you please on a circular frame, so that you can have any kind of deformity you desire in the upper; there are as many in the lower. Before we go to any deformity it is well to show the natural form. I want to show you a type; we will take that of a type of a particular form of face. You note the shape of the jaw. Now you may go over the whole field that you require in orthodontia, you may take a line down the front of the brow, running through the alæ of the nose, resting on the lower lip and touching the chin. You can illustrate that very clearly to a class. They will get the type—the normal type, what they aim to have. Now then, put all kinds of variations—any that you choose; for instance, there you make a sneer of it—and make any kind of lower jaw that you please—lower lip—note the difference here; that is No. 2. Well, come on here, note that chin in the division around here—turn it around again. Note the difference there. See the juvenile nose on there. You may turn in another; look at that lower lip, then put the negro's lower lip on that, and so on. I do not wish to detain you any longer, but you see the principle.

This has been under development for some time. There are some little defects in it that we expect before very long to fix, so that we make four movable areas of the face, each moving separately, but you have grasped the idea.

A MEMBER: Is this original with Dr. Pearson, or did he get the idea of Dr. Case? Dr. Case has used that plan for several years —not the revolving, but the plan.

DR. WEBSTER: I see what you mean. The revolving part is what Dr. Pearson claims.

MINUTES.

NASHVILLE, TENN., Thursday, Dec. 27, 1900.

The eighth annual meeting convened at the Maxwell House at 11 o'clock A. M. with the president, Harry P. Carlton, in the chair.

After the meeting was called to order an address of welcome was delivered in behalf of the local dentists by D. R. Stubblefield, of Nashville. It was responded to by Truman W. Brophy, of Chicago.

The roll call of colleges then proceeded, showing twenty-two represented.

Moved and supported that the reading of the minutes be dispensed with and that they be approved as printed.

The annual report of the secretary-treasurer was then read and referred to the executive board.

The report of the executive board was made by chairman, H. W. Morgan. Moved and supported that the same be approved and adopted.

The report of the local committee of arrangements was then made by H. W. Morgan and upon motion was accepted.

The report of the committee on the Paris exhibit was read by H. J. Goslee as follows. Moved that the same be accepted and approved, and that a vote of thanks be extended to the colleges contributing and to the committee, and that the latter be discharged. Carried.

REPORT OF THE COMMITTEE ON EXHIBIT AT PARIS EXPOSITION.

Your committee, appointed by the chair, and created by a resolution adopted at our last meeting, to solicit and collect from the various colleges in the membership of our body an exhibit of models, charts and technic work of students, to be placed upon exhibition as the contribution of the "Institute of Dental Pedagogics" at the International Exposition at Paris, beg leave to submit the following:

Immediately after their appointment application was made to the offices of the commissioner general for the United States for space, which proved difficult to secure, because we were late and already most of the offices were closed, and all available space previously assigned. Through persistent effort and the courtesy of the director of liberal arts such was finally granted us, however, and, while not the most desirable, was the best that could be done under the circumstances; and, while preferring space in the department of education, where such an exhibit properly belonged, we had to be content with 6 by 10 feet in the Liberal Arts Building

Circular letters were then issued at once to each college enjoying the privilege of membership in our body, stating that space had been secured and urging them to join in the contributions to the success of our exhibit.

Owing to the short space of time we had to prepare for same, and because some colleges had already arranged to make theirs in connection with the universities of which they were a part, only five responded favorably. These were the Philadelphia Dental College, the Dental Department of the University of California, the Dental Department of Vanderbilt University, the Dental Department of the Western Reserve University and the Chicago College of Dental Surgery, each of which sent to your committee an exhibit well worthy of representing the work done by the students, and the facilities for teaching of the dental colleges of America.

About this time the work of your committee was somewhat handicapped by the resignation of Dr. Whitslar, of Cleveland, on account of illness and of Dr. Brophy, of Chicago, but their places were filled soon after by the appointment of Drs. A. O. Hunt and D. M. Cattell.

The five exhibits were then properly grouped and arranged, and after being submitted to, and meeting with, the approval of the committee, were boxed and duly consigned to Paris, on or about March 20; and inasmuch as they were of such a nature as to reflect much credit upon our organization, it is a matter of deep regret that we did not begin earlier, that we may have had a larger exhibit and a better space assigned us.

The services of Dr. Winthrop Girling, of Chicago, whose duties called him to Europe about the opening of the exposition, were secured, to supervise the arrangement of the exhibit; and, while he reached there much later than he had expected, and found the exhibit already installed, through the courtesy of the Department of Liberal Arts and of the representatives of Gideon Sibley, he did much to rearrange and add to the prominence of same.

As a whole, however, notwithstanding the energy expended and the faithful efforts of all interested and concerned, your committee.

with apologies and regret, feel constrained to announce that the exhibit was not the success that it, or the society, deserved; but also feel that this can only be attributed to the fact that we planned well but *late*, and that we had no direct representative to receive and arrange things for us at the proper time and in the proper manner.

Arrangements have been made with Gideon Sibley's representatives to take charge of the repacking and shipping of the exhibit at as early a date as it could be removed from the building and the receipt of the same has been daily expected for some time.

In conclusion, your secretary suggests that the thanks of the society should be extended to the colleges contributing, which contribution deprived some of them from making an exhibit at this meeting; to the representatives of Gideon Sibley, and to Dr. Winthrop Girling. Respectfully submitted, (*Signed*)

HART J. GOSLEE, Secretary.

A recess of ten minutes was then declared in order to allow for the presentation of delegate certificates and the payment of dues.

The applications for membership of the Washington Dental College, the Dental Department of the Medico-Chirurgical College of Philadelphia and the Illinois School of Dentistry were read by the secretary and referred to the executive board.

The resignation from membership of the Columbian Dental College of Washington, D. C., was announced and referred to the executive board.

The vice president was then called to the chair and the president delivered his annual address. The discussion was opened by H. B. Tileston, continued by Tenney, Webster, Barrett (read by secretary), Hunt, Weeks, Kennerly, Brown, Brophy, Black and closed by the essayist.

Adjourned.

2:30 P. M.

The meeting was called to order by the president.

The minutes of the previous session were approved as corrected.

The executive board made a report recommending the admission to membership of the three colleges whose applications had been presented and the acceptance of the one resignation tendered.

Upon motion the rules were suspended and the applications voted on collectively.

The ballot being clear it was moved and supported that these colleges be declared elected.

Moved that the resignation tendered be then accepted. Carried.

J. Q. Byram then read a paper on "The Use of Flexible Rubber in Orthodontia and Other Technic Teaching." The discussion was opened by W. E. Grant, continued by Cattell, Jameson, Webster, Weiss, Patterson, Weeks, Brown, Hunt, Goslee, Brophy and closed by the essayist.

A. H. Peck read a paper on "Teaching of Materia Medica and Therapeutics, How and How Much." The discussion was opened by the reading of discussions from James Truman and J. I. Hart by the secretary, continued by Foster, Hunt, Patterson, Black, and was then, upon motion, deferred until the following morning as a special order.

An invitation was then extended by Dr. J. P. Gray to visit the Dental Department of the University of Tennessee immediately after adjournment, which was accepted.

Adjourned.

8:15 P. M.

The meeting was called to order by the president.

Reading of the minutes of previous session deferred.

F. B. Noyes then read a paper on "The Use of the Lantern in Teaching Dental Histology in Its Relation to Operative Dentistry." The discussion was opened by H. T. Smith, continued by Weeks, Cook, Walker, Merrill, Hoff, Morgan, Patterson, Black, Whitslar and closed by the essayist.

Adjourned.

FRIDAY MORNING, Dec. 28, 1900.
10:30 A. M.

The meeting was called to order by the vice president.

The discussion of the paper by A. H. Peck was then continued by Hoff, Brophy, Hunt, Black, Brown, Noyes, Kennerly and closed by the essayist.

The executive committee then reported minor changes in the programme and entertainment.

The secretary made a report regarding transportation certificates.

Dr. George E. Hunt extended a general invitation to all to attend the Tri-State Dental meeting to be held at Indianapolis, Indiana, in June.

Dr. Thomas E. Weeks read a paper on "The Technic of Crown and Bridge Work, Metal and Porcelain." The discussion was opened by N. S. Hoff, continued by Hillyer, Wilson, Goslee and closed by the essayist.

Adjourned.

2 P. M.

The delegates assembled to leave in a body to visit the Dental Department of Vanderbilt University, from which they left at 3 o'clock on a special car to attend a genuine southern barbecue at Glendale Park.

8:30 P. M.

The meeting was called to order by the president.

The minutes of the previous sessions were read and approved.

The secretary announced that the Southeastern Passenger Association would honor all certificates for one-third return fare in their territory.

Dr. G. V. I. Brown read a paper on "Class-room Method of Teaching Oral Surgery." The discussion was opened by G. V. Black, continued by Hoff and closed by the essayist.

Dr. A. E. Webster presented a paper on "A New Feature in Teaching Dental Anatomy and Operative Technics." The discussion was opened by G. V. Black, continued by Dittmar, Whitslar, Tenney, Kenyon, Byram and closed by the essayist.

The secretary announced an attendance of sixty-five, representing twenty-three colleges, twenty-two of which had qualified.

An invitation to visit the Dental Department of Meharry Medical College was accepted and made a special order for 9 o'clock the next morning.

Adjourned.

SATURDAY, Dec. 29, 1900.
10 A. M.

The meeting was called to order by the president.

The report of the committee on constitution and by-laws, as presented by Chairman G. E. Hunt, was taken up as the first order of business.

The proposed constitution and by-laws were read and adopted, section by section and article by article.

Upon motion they were then adopted as a whole as read and corrected.

Moved that the reading of minutes of previous session be deferred. Carried.

The report of the master of exhibits, George H. Wilson, was made, and was upon motion accepted and approved with a vote of thanks.

The executive board reported a favorable examination of the accounts of the secretary-treasurer, which was upon motion accepted and approved.

A consideration of the next place of meeting was indulged in and discussed by Tenney, Morgan, Hunt, Hillyer, Whitslar and Hoff, but no action was taken and the question was referred to the executive board.

A change in the time of holding meetings was then suggested. It was discussed by Hunt, Morgan, Weeks, Black, Goslee, Gray, Byram, Webster, Patterson, Cattell, Kennerly and Noyes, and referred to executive board without action.

The final reports of the executive board and the committee of arrangements were made by the chairman of each, H. W. Morgan, and were upon motion received and accepted with a vote of thanks.

The election of officers then proceeded and resulted as follows: President, George E. Hunt; vice president, Hart J. Goslee; secretary-treasurer, H. P. Tileston; member executive board (three years), to succeed H. W. Morgan, term expired, W. H. Whitslar.

The newly-elected officers were then installed and responded in a fitting and appropriate manner.

Upon motion a vote of thanks was then extended to the profession of Nashville and their wives and to the Maxwell House, for courtesies extended.

The minutes of this and the preceding sessions were then read and approved. Respectfully submitted, (*Signed*)

HART J. GOSLEE, Secretary-Treasurer.

APPENDIX.

List of Membership Colleges with duly accredited representatives present, dues paid and entitled to vote:

College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Northwestern University Dental School.
Royal College of Dental Surgeons.
Dental Department of Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
Dental Department, University of California.
Indiana Dental College.
Dental Department, University of Buffalo.
Pittsburg Dental College.
New York College of Dentistry.
Dental Department, University of Iowa.
Birmingham Dental College.
Kansas City Dental College.
Dental Department, University of Tennessee.
Southern Dental College.
Atlanta Dental College.
Dental Department, Milwaukee Medical College.
Missouri Dental College.
Illinois School of Dentistry.

BY PROXY.

Dental Department, University of Omaha.

MEMBERSHIP COLLEGES WITHOUT ACCREDITED DELEGATES.

Dental Department, University of Pennsylvania.
Baltimore College of Dental Surgery.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery.
Dental Department, Ohio Medical University.
Cincinnati College of Dental Surgery.
Dental Department, Detroit College of Medicine.
Dental Department, Marion Sims College of Medicine.

Total membership, 32.
Colleges represented by delegates, 24.
Colleges without delegates, 8.
Colleges admitted at this meeting, 3.
Resignations received and accepted, 1.
Dropped for nonpayment of dues, 1.

Respectfully submitted,
(Signed) Hart J. Goslee,
Secretary-Treasurer.

REVISED CONSTITUTION AND BY-LAWS.

ARTICLE I.

NAME AND OBJECT.

SECTION 1. This association shall be known as the "Institute of Dental Pedagogics."

Sec. 2. Its object shall be the improvement of the educational department of the colleges comprising its membership, by interchange of thought and formulation of methods.

ARTICLE II.

OFFICERS AND STANDING COMMITTEE.

SECTION 1. The officers shall be a President, Vice President and Secretary-Treasurer, the same to be selected from the active members and elected by a majority ballot at the annual meeting.

Sec. 2. There shall be one standing committee of three members, which shall be known as the Executive Board, the same to be elected by a majority ballot at the annual meeting.

Sec. 3. The Executive Board shall be elected and serve as follows: At each annual meeting there shall be one member elected to serve for three years.

ARTICLE III.

MEETINGS AND QUORUM.

SECTION 1. The regular meeting shall be held annually at such time and place as may be decided upon by the Executive Board.

Sec. 2. On the written application of the representatives of seven colleges the President may, on thirty days' notice, call special meetings to be held at such places as may be most convenient.

Sec. 3. Representatives from ten colleges shall constitute a quorum.

ARTICLE IV.

MEMBERS AND DUES.

SECTION 1. Any college that is a member in good standing of the National Association of Dental Faculties is eligible to apply for membership in this body.

Sec. 2. Active members shall consist of accredited representatives from the teaching staff of the colleges holding membership.

Sec. 3. Each college holding membership in this body may accredit one or more of its teaching staff as its representatives and such representatives shall be entitled to all the privileges of the Institute, *except that no college shall cast more than one vote on any matter acted on by the Institute.*

Sec. 4. The annual dues shall be ten dollars ($10.00) from each college, payable in advance. *The dues of a college must be paid before its representatives can take part in the proceedings of the Institute.*

ARTICLE V.

APPLICATION FOR MEMBERSHIP.

SECTION 1. Applications for membership shall be made in writing to the Secretary-Treasurer. They shall be referred to the Executive Board to be reported on at the first session of the meeting after the receipt of the applications.

SEC. 2. A favorable report from the Executive Board, followed by a favorable vote of two-thirds of the voting representatives present, is necessary to elect the applicant to membership.

ARTICLE VI.

FUNDS.

SECTION 1. All funds shall be applied to the necessary expenses of the Institute and shall be paid out by the Secretary-Treasurer as ordered or as bills are approved by two members of the Executive Board.

ARTICLE VII.

ALTERATIONS AND AMENDMENTS.

SECTION 1. Any amendment to the Constitution or By-Laws shall be proposed in writing at a regular meeting. It shall lay over until the next annual meeting and every active member be notified of such proposed amendment, when it may be adopted by an affirmative vote of two-thirds of the active members present.

ARTICLE VIII.

SECTION 1. Roberts' Rules of Order shall be the authority governing this body.

BY-LAWS.

ARTICLE I.

DUTIES OF OFFICERS.

SECTION 1. The duties of the President and Vice President shall be such as usually pertain to these offices in similar organizations.

SEC. 2. The duties of the Secretary-Treasurer shall be such as pertain to the office of Secretary and Treasurer in similar organizations.

SEC. 3. The President and Secretary-Treasurer shall render an annual report.

ARTICLE II.

DUTIES OF EXECUTIVE BOARD.

SECTION 1. The Executive Board shall receive and act upon all applications for membership. It shall receive and act upon all bills presented to the Institute. It shall provide a program for each regular meeting, which shall be in the nature of papers, exhibits or reports from members upon the several topics pertaining to Dental Pedagogics.

Sec. 2. It shall attend to all business of the Institute and render an annual report of its transactions, which shall be published.

Sec. 3. It shall select the place for each meeting and provide the necessary arrangements.

ARTICLE III.

LOSS OF MEMBERSHIP.

Section 1. Any college that is in arrears for two years' dues shall be dropped from the roll.

Sec. 2. Any college that fails to send a representative for three regular meetings shall be dropped from the roll.

Sec. 3. Any college that is dropped from membership in the National Association of Dental Faculties shall be dropped from the roll.

Sec. 4. Any college dropped from the roll for causes mentioned in Sections 1 and 2 of this article shall be required to pay all dues owing at the time it was dropped before it can be voted on for re-instatement.

ARTICLE IV.

MASTER OF EXHIBITS.

Section 1. At each annual meeting the Executive Board shall appoint a Master of Exhibits to serve until the close of the next annual meeting. He shall have full charge of the exhibits and shall make a report to the Institute.

NEXT MEETING.

The next meeting will take place at the Seventh Avenue Hotel, Pittsburg, Pa., December thirty-first, nineteen hundred and one, and continue for three days. A large and interesting programme will be presented.

PROCEEDINGS

OF THE

NINTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics.

(Formerly National School of Dental Technics.)

HELD AT PITTSBURG, PA., DECEMBER 31, 1901,
TO JANUARY 2, 1902.

SIXTH VOLUME, PUBLISHED 1902.

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PREFATORY NOTICE.

The Publication Committee submits this report of the proceedings of the Ninth Annual Meeting without apology for having made an effort to present only the essence and substance of the discussions, believing that the exercise of such discretion will place on record a fair, liberal, and more interesting statement of the work accomplished.

Hart J. Goslee,
Geo. E. Hunt,
H. B. Tileston.

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ADDRESS OF WELCOME.

By J. A. LIBBEY, D.D.S., Pittsburg.

Mr. President and Gentlemen: I think the president was well informed when he said "a short speech." The committee said, "We only want a short speech,"—and that is what you will get.

I am very much pleased, gentlemen, to be placed in the position to welcome you to Pittsburg. Most of the faces here are familiar to me, as I see them annually at our National Association; many of them are associates of mine, and it is a great pleasure to me to welcome you to our town.

I understand that one of the rules of your association is that you don't want to be interfered with in the way of entertainment,—that you come here to work. But we don't want you to leave our town without seeing a little of it. If you see nothing but what you have seen since you came in this morning, I know you will go away with a bad impression. I suppose none of you are disappointed in the matter of our cloudy atmosphere; we have a reputation for that. But we want you to see a little more.

Pittsburg is a town with a beautiful history. It was settled here shortly after the Revolutionary War, and the pathfinders to this part were the Scotch-Irish, which class predominates to a great extent to-day, and you will see many of their characteristics even now. Among the first industries of our place at that time was agriculture, and the principal products were grain, wheat, rye, and Indian corn. The only outlet we had for our market was to New Orleans by flat-boat or to Philadelphia and the East by pack, and it was very difficult to carry grain that distance. The result was that the rye was turned into high wines and packed overland. That industry still continues here to some extent. And also the tastes of the Scotch-Irish are still with us. I must say for our city that you will find one thing if you stay over Sunday; that you will have more difficulty in getting refreshments or cigars on that day than in any other city, I suppose, in the country; we have closed doors on Sunday.

Our city has grown until we are placed eleventh in the list by the last census. It is surrounded by innumerable cities and towns, and if we had as much area as all of the cities that are about us, instead of being eleventh we would be fourth, as we have a population, within an area of fifteen miles, of over 600,000 people.

We have many places of interest we would like you to see. The chancellor of the University, who, raised from a mill-man, has become now an authority in astronomy and in the manufacturing of lenses for our finest telescopes, has a laboratory which will be a very interesting thing for all of you to see. Then our mills, the plate works, or the pipe works. I don't know what the committee has arranged for you, but if any of you want to see any of these things I will appoint myself a committee of one to assist the others.

Gentlemen, I have nothing more to say than to bid you all a hearty welcome to Pittsburg.

RESPONSE TO ADDRESS OF WELCOME.

By D. R. STUBBLEFIELD, M.D., D.D.S., Nashville, Tenn.

Mr. President and Gentlemen: Our president was too flatteringly kind in imposing upon me this task. It would have been pleasant if I had had some time in which to collect my thoughts, but I am afraid that under these circumstances it will not be pleasant to me or to those who hear. But it came with my birth to make some appreciation of courtesies offered and kindness given; therefore I reluctantly, I must say, yielded myself to this opportunity to voice such sentiments for this Institute.

We make our acknowledgments to Dr. Libbey: We appreciate, sir, your cordial welcome, and we hold in pleasant anticipation the interesting points to visit and sights to see. This association comes to Pittsburg, as to other places, because it represents an up-to-date, living, working body, filled with high aspirations and vibrating with life and modern ideas. We represent a profession that, if it be not appreciated in Pittsburg, certainly ought to be. The world is beginning to appreciate it, and Pittsburg with its 600,000 inhabitants, possibly, certainly does appreciate it, or ought to. We will no doubt enjoy in this hall full compensation for our arduous journeys, and we expect to reap personal benefit from this meeting together. We thank our hosts, singly and collectively, and we propose to conduct ourselves so that, should we remain until after Sunday, Pittsburg will not be offended by our presence. If our president gives us his promise to restrain himself, then I think the rest of us may easily follow in his wake.

Personally, I am very much pleased to be in Pittsburg. The first time I ever saw the city was about seven o'clock one cloudy morning (it seems that is the only kind of mornings they have here) and as I looked out of the car window I saw a sight that I had never seen before. Then occurred to me the words of one of our humorists in describing Pittsburg, who said that Pittsburg was "hell with the lid off." I thought that was just about right. Dr. Libbey says he is going to take us down underneath. I don't know whether we can trust ourselves to visit it there,—at least singly, though we might go collectively. I don't know whether I want to go down under the lid or not, but, with his assurance to go first every time into every place, I will follow the leader.

In anticipation of our pleasant sojourn, then, I voice the thanks of the association for the welcome offered and express our acknowledgments for the cordial greetings.

PRESIDENT'S ADDRESS.

By GEO. EDWIN HUNT, M.D., D.D.S., INDIANAPOLIS.

GENTLEMEN: This is the ninth annual meeting of this body. Seven of the previous sessions were held under the name of the National School of Dental Technics; the last one under our present name of the Institute of Dental Pedagogics. The success of the organization has been such that no apology for its existence has ever been needed. It has probably contributed more, in a direct way, to unify and to elevate the quality of the instruction given in our dental colleges than any other agency. The effect upon the profession at large will be readily apparent in the years to come. We may all well be pleased with what has already been accomplished and look forward with confidence and eagerness to the work of the future.

In casting about for a subject upon which to address you, the near advent of the four years' course and the consequent necessary curriculum changes naturally occurred to my mind. My first thought was that a consideration of that question in this body might be construed as a usurpation of the prerogatives of the National Association of Dental Faculties. But upon receiving encouragement from some of those now present I decided that if we can come to any conclusion on this subject and refer it to the National Association of Dental Faculties, it will save time and work in that organization. In my recommendations I have said nothing regarding the amount of time to be devoted to any subject in any year. This has purposely been avoided. If we can unify the curriculum so that all the colleges teach the same subjects during the same year it will probably be all that can be accomplished. Even that will be difficult.

The first year of a four years' course will naturally be devoted to elementary and fundamental work. With a view to increasing the desired correlation of eye and finger, and especially with a hope to produce ambidexterity in many, freehand drawing, using both right and left hands, will be found most valuable. This course should be in the hands of a competent drawing teacher and should preferably consist of both blackboard and desk drawing. The endeavor should be to train the left hand to an equal amount of dexterity with the right, and to train both to reproduce on the board, or on paper, geometric and other figures as seen by the eye.

Several years' trial of a course in physics for freshman dental students has convinced me of its value. As the entrance requirement is now such that practically all of our students have had high school physics, it will be possible to give an advanced course in that subject. This is of such importance that no school can afford to neglect it. The use of the lantern projector and the apparatus designed and sold for the pursuit of this study in our schools and colleges has made it one of the most interesting and instructive branches that can be included in the curriculum.

Biology is another subject that should be included in the work of the first year. It broadens the mind, gives that general scientific knowledge that goes to make up a well-informed professional man, and leads directly to the intelligent pursuit of such studies as physiology and bacteriology.

Comparative dental anatomy is still another subject that has not received its due measure of attention. It should by all means be included in the list. The present drawback to the pursuit of the study lies in the fact that there is no perfectly satisfactory text-book on the subject, and the student is compelled to gather his knowledge piece by piece, a little here and a little there, and all of it obscured by a mass of other matter not directly relating to the subject. The best work at present extant is that of Dr. Thompson.

I would therefore recommend that the studies of the first year be osteology, histology, biology, chemistry, dental anatomy and development, prosthetic dentistry, physics, and drawing, with such histological, biological, chemical, and dental laboratory work as will naturally occur in the elaboration of the didactic course. It will be noticed that I have refused dissection a place in the first year's work. The freshman student accomplishes but little in the dissecting-room, because he does not know enough anatomy to make the course of value.

In the second year I would recommend the following studies: Anatomy, physiology, chemistry, operative dentistry, comparative dental anatomy, prosthetic dentistry, materia medica, bacteriology, and dissecting. The laboratory work would be in the elaboration of chemistry, bacteriology, and operative and prosthetic dentistry. I am classifying crown- and bridge-work in prosthetic dentistry, and would do some technic work in this branch in this year.

In the third year I would recommend anatomy, physiology, chemistry, operative dentistry, prosthetic dentistry, orthodontia, therapeutics, bacteriology, general pathology, anesthetics, and dissecting. The laboratory work would include chemistry, operative and prosthetic dentistry, orthodontia, bacteriology, and pathology.

In the fourth year the studies would be operative dentistry, prosthetic dentistry, orthodontia, dental pathology, neurology, general and oral surgery, dental jurisprudence, and conduct of practice.

This is but a brief outline; the details will readily suggest themselves. For instance, in the fourth year, neurology would include enough otology, rhinology, laryngology, and ophthalmology to give the dental student as much or more knowledge of these subjects than is acquired by the general medical student. As I have repeatedly stated on the floor at these meetings, our endeavor should be to make the dental college curriculum such that the degree of Doctor of Dental Surgery will carry with it a breadth of knowledge and a wealth of attainment that will put its possessor on a plane with those who have taken the degree of Doctor of Medicine. A dental college graduate should have taken practically the same course that his medical *confrère* followed, with the exception of obstetrics, general surgery, and theory and practice of medicine.

The question of examination is one of considerable interest and importance. Too many teachers in professional schools are inclined to believe that their duty to the student has been fulfilled when they have delivered their course of lectures from the rostrum. Loose habits in conducting examinations are readily noted by the students, and information regarding those teachers who are rigid in their tests and those who are the reverse are handed down from class to class. There are always some students in each class whose thirst for knowledge and whose ambition to excel will cause them to do their best without a special incentive, but there are more who will neglect certain branches if they believe that the examinations in those branches will be particularly easy. The object of an examination should not be so much to learn what the student knows as to learn what he does not know. The latter is by far of the most importance. The question of how many examinations to hold in a term can perhaps best be determined by the individual teacher. In some schools monthly examinations are held. My personal experience with that plan leads me to believe that many in the class industriously forget all of the previous month's work as soon as the examination has been held. This plan also entails considerable labor on the part of the teacher without producing commensurate results. On the other hand, one examination on the year's work is hardly sufficient, as in order to cover the ground thoroughly it would require that a considerable number of questions be asked. It is probable that two examinations per year, one at mid-term and one at the close of the year, will give the best results.

Whether the examination be written or oral is also to some extent a matter of preference with the teacher. There are undoubtedly some students to whom an oral examination is a hardship. In every class a few will be met that become nervous to the point of being unable to express themselves in answering questions orally. The tact of the teacher can here be shown in overcoming the timidity and giving the student confidence in himself. Written examinations are seldom a fair test, and frequently result in dissatisfaction among those who take them fairly. I have seen many teachers who asserted that no student could cheat at one of their written examinations, but I have never seen a written examination at which a shrewd student could not get illegal help. Many students will exert more perseverance and labor in preparing notes for an examination than would be necessary to properly prepare themselves for taking it without cheating. One objection that is urged against oral examinations is the length of time required for examining a large class, but if the teacher conscientiously examines every paper in its entirety the time required is fully as great as that necessary for oral examination.

The following plan has given the best results in my work: Five students are admitted to the examination room at one time, and have each of them five questions 'asked him. A previous acquaintance with their work and their knowledge of the subject as displayed in their answers to these questions usually permits the granting of a passing grade to the majority of the class without further hesitancy. In case of any doubt or in case a student has failed on one or more questions, additional questions are asked until fifteen minutes' time has expired with this division. These five are then dismissed and another section called. Those who are not clearly entitled to a passing grade are requested to come again at a later hour, and at that time are asked from ten to fifty questions until I am assured that they are, or are not, entitled to a passing grade. To cover four months' work with ten written questions is frequently an injustice. It might easily chance that a fairly well informed student should fail on three of the ten and yet be able to answer ninety per cent. out of one hundred questions covering the same period of work.

In holding oral examinations I have a list of over one hundred questions covering the work since the last examination. A printed class roll makes a convenient paper on which to mark the grades. As I ask the question, I put its number down opposite the name of the student to whom the question is given, and grade him on his answer. In this way my grade for the examination is not my *impression* of his deserts, but the average of the credits given for each question while the answer is fresh in my mind. This method also permits me to refer to each student's examination if for any reason that is desirable. I urge upon the members of this Institute greater care in their examination work.

In closing this rather defective address allow me to express my high appreciation of the honor conferred upon me by my selection as presiding officer of this body for the fiscal year so soon to be completed. My acquaintance with dental society work has been quite extended, but I can truthfully state that the presidency of this Institute, coming as it does without political intrigue or objectionable ward primary methods, is to me one of the greatest honors that can be conferred. It gives me pleasure to testify to the untiring energy and ability of Chairman D. M. Cattell and the other members of the Executive Committee. My thanks are also due to the other officers of the Institute. Trusting that our session here will be filled with profit and not devoid of pleasure, I close with the earnest wish of "A happy and prosperous new year!" to all.

DISCUSSION.

Dr. J. Taft. The paper presented by the president as his annual address is one of interest to the profession and of very great interest to all those who are engaged in teaching. Without question there should be greater uniformity in college work than has ever as yet obtained. There is, however, improvement being made in this direction by the efforts of the National Association of Dental Faculties, as well as by this body, and the efforts put forth by each of these organizations should be fostered and every effort made to secure the largest and most desirable results for the work of each.

It has been rather unfortunate that there was so much diversity of methods in different colleges. The effort should be to secure as nearly as possible a uniformity in the methods of procedure, in order that the college-trained men of all professions should stand as nearly as possible upon the same level. This is impossible while there is so much diversity in the methods of instruction. There certainly need be no fear of "a usurpation of the prerogatives of either of these bodies by the other." There is certainly enough valuable work to be done without a risk of anything of that kind.

A few years ago an effort was made to introduce into the work of the National Association of Dental Faculties the subject of methods of teaching. But owing to the preoccupation of the time of the body in dealing with the principles underlying college work, hardly anything was accomplished in the line upon which the Association of Dental Pedagogics is and has been at work. It is, and has been, the opinion of many that there is ample work and room for both of these bodies. The aim of each in the work is for the same purpose. The writer says, "If we can unify the curriculum so that colleges teach the same subjects during the same year, it will probably be all that can be accomplished." Certainly no objection can be made to this statement, and the attainment of the end contemplated would be very desirable. The definite unification of the curriculum of the different schools, so far as the years are concerned, is certainly desirable, and especially so if students are to change from one school to another.

The position taken in the paper, that preparatory technic work on the part of the student is very desirable, can hardly be questioned. There is certainly no professional calling in which such training would be more desirable than in that of dental practice.

That the five senses should be trained to be as nearly under control of the mind as possible, and that such training should be commenced early in life if the best results are to be obtained, there can be no doubt.

The question of securing uniformity in the matter of the use of the hands would be, in many respects, desirable if its accomplishment were easily attained, but, as a rule, the attainment of this end would be exceptional, especially if it were attempted after fifteen years of age. The capability of the left hand to equal the right seems in some cases to be a natural endowment; this is quite exceptional, however. While all possible results should be obtained for both the hands, we think it quite evident that in a great majority of cases both cannot be brought to the same degree of attainment.

With the paper I fully agree that technical training should be had in our elementary schools, and this with reference to all the ordinary callings of life; and nowhere is it more important than with those who contemplate entering the practice of our profession.

To the statement made in the paper that "Comparative dental anatomy, especially of the teeth, is a subject that has not received its due measure of attention," no one, I think, would take exception. The author very properly refers to an obstacle that in a measure stands in the way, namely, the want of satisfactory text-books on the subject, so that, as he states, the student "is compelled to gather his knowledge piece by piece, a little here and a little there." In addition to this we may venture the suggestion that the lack here is not as great as in the want of material for illustration in the way of specimens. There are very few, if any, dental colleges as fully supplied in this respect as they ought to be. The well-equipped museum of preparations for teaching in various branches of our curriculum is a serious deficiency. Indeed, we regard a well-equipped library, as well as a museum, a necessity for the proper training of dental students. The work referred to by the writer is a very good one indeed, so far as it goes, but we think Dr. Thompson himself would not claim that his work is all that is needed.

The author of the paper advises against the freshman student entering the dissecting room. This view we think correct, but we believe that the freshman student might have the articulated manikin along with his text-book to very decided advantage. This perhaps could be used with greater benefit in the lecture room before the freshman class during their study of anatomy. Certainly after this course the advantages of the dissecting room would be much augmented, either in the second or third year, after such training in the lecture room.

The suggestion may here be ventured that the subject of hygiene and sanitary science is not as fully emphasized in this paper as its importance demands. Should it not be regarded as fundamental in all medical science and practice? The world is beginning more and more to understand and appreciate this fact. We are in full accord with the statement that "The Dental College curriculum should be such that a degree of Doctor of Dental Surgery will carry with it a breadth of knowledge and a wealth of attainment that would put its possessor on a plane with those who have taken the degree of Doctor of Medicine."

The paper suggests several considerations in regard to examinations, nearly all of which are valuable. After all, the question of examination is one of the vexing matters that is not easily determined by any fixed method of procedure. All of the suggestions here presented are worthy of consideration. Some are valuable in one case and worthless in others, and it devolves upon each individual examiner as to the precise method he shall pursue with the individuals who come within his charge.

Every teacher should study the phases of the mental conditions and attainments of those who are his pupils. The teacher should always be thoroughly interested in the subject or subjects he attempts to teach, and should ascertain and use the most effective methods of pressing home to the attention of his students the subject in hand.

I cannot do less than express my appreciation of this address of our president. If the suggestions are followed out and utilized as they may be, doubtless a great step will have been gained in the work of the teacher.

J. H. KENNERLY. Some weeks ago I received a letter from the president, Dr. Geo. E. Hunt, saying that he had mailed me a copy of his address, and asking that I tear it all to pieces, as he was looking for trouble. I am sorry to say that I am unable to accommodate him at this time, from the fact that I most heartily agree with most of the suggestions advanced in the doctor's address, while we are all aware of the exceeding versatility of our president as a writer. The subject chosen by him for his address before this association I believe to be especially appropriate for this occasion. As to the consideration of the four-year curriculum by this body, at this time, being a usurpation of the prerogatives of the National Association of Dental Faculties, I feel assured that the chairman of the Committee on Curriculum of the National Association of Dental Faculties, who is present at this meeting, as well as the association proper, will welcome any discussion as well as suggestions that may come from this body to aid them in formulating a curriculum for the coming four-year course of instruction. Even though it be a fact that the four-year course does not go into general effect until the term of 1902-3, yet the discussion of the subject at this time is perfectly proper.

As to the division of the subjects to be taught during the several years of the course, I cannot agree with all the essayist recommends. I do believe, however, that the addition of physics and freehand drawing would be of great benefit to the student. Biology would broaden the foundation,—a thing much to be desired. The placing of dissection in the second instead of the first year would certainly be a great benefit to the student. He would then have had one course of lectures on anatomy, and would be the better enabled to comprehend the complex construction of the human form. It does seem to me, however, that the essayist demands too much of anatomy, chemistry, and physiology. I believe that the average student can get quite a sufficiency of the subjects in two terms of from seven to nine months,—more than is usually taught in medical schools that have a graded course.

The course as outlined for the fourth year seems to me to be most admirably arranged. The addition of neurology to the course will certainly be of great benefit to the student. It will enable him to make a better diagnosis of those cases which involve the eye and ear as well as the teeth. I had the pleasure some few weeks ago of listening to a paper by one of the leading ophthalmologists of the West, which was read before one of the dental societies of St. Louis, and I am sure that you gentlemen would have esteemed it a favor to have listened to such a paper. Concerning the examination of students, I am in perfect accord with the ideas of the essayist. I believe that an oral examination is the only one by which we can arrive at the desired results. In those schools where the classes are very large it would entail a great amount of labor, but not much more than would be consumed in correcting an equal number of badly written examination papers, and the results would be much more satisfactory. In conclusion I wish to say that the address is a most admirable one, characteristic of the gentleman who prepared it.

Dr. D. R. STUBBLEFIELD. I want to commend most of this address and give to it my hearty indorsement, especially to certain innovations which we must introduce into our work to adequately cover the extended time. As far as these new subjects are concerned, there is no discussion, it seems to me. But I wish to express some personal views, that are rather antagonistic, upon the subject of examinations. The essayist opens up with a statement that we all indorse, that it is wise for us to unify the curriculum of the various schools. Why? Because it gives a uniformity of instruction, and possibly for the benefit of those who wish to change from school to school, and for various other reasons that I need not mention. But why cannot the same idea be applied to the examinations? Further on it is stated and indorsed that only the oral examination is the proper one. Now I believe that you can give no such thing as an exact examination, impartial from start to finish, without giving a series of written questions. I know it is a fact that a man can write one hundred questions, all of which are pertinent to the subject, but I don't believe that any man should expect a student to answer all of them, and I don't believe that any five questions he may ask will adequately discover the general knowledge of the student. I think it is beyond question that, if you have anything like competitive work, you could not at all approximate a definite conclusion by oral examinations. In the first place, if a man asks a question, it is so easy by the very framing of it, by the intonation of voice, to convey to the student, either consciously or unconsciously, the way that it should be answered. You can ask a question with a kind of intonation that is appreciated at once, and the answer would be Yes, or, on the other hand, with a different intonation the answer would be No. So I maintain that no man can do A, B and C justice if there is anything like competitive results to be attained by oral examinations. On the other hand, it is claimed that not every man is able to express himself orally. Well, my conviction is that while a man may falteringly express himself, yet if he has a definite, clear comprehension of the question, sooner or later he will get to the end of it. You can't shake a man's conviction if he has a conviction, but if everything is vague you may throw him off at once. Then we come down to the general principle: How many men will we embarrass by the written questions as contrasted with the men embarrassed by oral answers? I claim that the percentage will not vary very much. Then, what will the ulterior results be? I claim that in the oral examination you can unconsciously aid a man, one with whom you are well acquainted. You ask him a question in a pleasant and agreeable manner that places him at his ease; the other man comes in who scarcely knows you, and he is at a disadvantage. I insist that the only fair way to give an examination is by a limited series of questions which intelligently cover the fundamental principles of the work. We don't expect them to write text-books, but the object aimed at is to find out how well they are grounded in the rudiments of the subject.

Students frequently say after an oral examination: "He asked me five questions and if he had asked me any other of the ninety-five I could have answered them." I claim that you cannot in five questions give a student as fair a chance to exhibit his knowledge from start to finish as you can in ten rudimentary or salient points of inquiry. I say that in the opportunity of quietly writing, all of them having an adequate length of time to give a fair expression of at least a rudimentary acquaintance with the subject, the outcome will be more exact and satisfactory in the end, and come nearer to being a fair test of the average student's ability.

As I say, with reference to the innovation of the introduction of physics and freehand drawing, the teaching of ambidexterity, and the study of neurology, we all indorse that, and I congratulate the president that he has so intelligently looked over the field.

Dr. F. D. Weisse. This is the first time in my remembrance of the transactions of this body that the question of examinations has been brought up; it is one fraught with interest and deserves close consideration.

When our college was organized and the question arose as to methods of examination, we adopted the practice of both written and oral examinations in order to meet the difficulty,—that some men can express themselves in writing and cannot express themselves orally, and *vice versa*. We have seen no reason to change during the years of the existence of the college. There are several ways of varying the oral examination, and I was interested in the scheme presented by the president in having five students come up to him at a time, as I occasionally do so myself. The plan is especially useful where one has a large number of students to examine in a limited time.

I have adopted during the past few years a method in the oral examinations that has recommended itself to me increasingly the more I have used it: I prepare slips with ten questions on each slip, each slip representing a scope of work to fairly well cover the department instruction. These slips I roll up and put on the table, and as a student comes in he draws a paper, the questions on that paper constituting his examination. We have all had the experience, after examining orally for three or four days, that the examiner becomes exhausted as to questions without undue repetition. When a student comes out from an oral examination, he is thoroughly pumped as to the questions that were asked him, so that by the time the examiner reaches the fortieth or fiftieth student he is somewhat embarrassed for new questions. If you have question papers arranged as above described there is no repetition, at least not too much, and the examinations go forward much more rapidly.

In our progress examinations at the close of the first and second years we have written examinations only on ten questions, whereas the eight final examinations of the third year are eight written—ten questions each—and eight oral. Our experience of years is that the student is fairly dealt with, and we have the possibility of reaching the student's knowledge of the respective subjects.

At the New York College of Dentistry we have weekly examinations, the professor of each department examining the class in a body each week. I obtained a very excellent suggestion some years ago from the transactions of this body, namely, that in calling up students for examination in class they be required to stand up. We find from experience that these weekly examinations bring the student into pleasant relation with the professors, and he learns the way questions are worded, so that when he comes up for his examinations he has more confidence in himself.

Dr. W. H. Whitslar. I think that in the small schools with which a number of us are connected the matter of examinations is rather an easy matter, for the reason that we come into such close contact with the pupils that we know their characteristics and are acquainted with what they know in the matter, so that we can tell without formal examinations exactly what their grade should be. Therefore the question of a written examination is a mere formality in most cases. We know a man by his work, what he is accomplishing and what the man really deserves in point of percentage in his work. I do not wish to go into the question of examinations farther, because I think the prime object of this paper was to discuss the curriculum of the colleges. The address began very courageously at the bottom of the scale by beginning with the subject of biology. Working from biology into the higher field of histology we come to the use of the microscope, and with this, freehand drawing. The use of the microscope should be thoroughly taught. It is a fine training for the hands and eyes. Then, following the line of histology throughout the normal and pathological studies, working up to that of bacteriology, which should receive its due portion. These are studies which come along progressively and should be utilized in all of their senses. I would like a place in the curriculum for physics, and if I were permitted to name it I should call it dental physics, because that name implies to the student information which would be applied directly to its use in dentistry. Then dental physics leads us properly to the consideration of electricity, and that has a place in the curriculum which I think the essayist did not mention. We should study electricity and its use in dentistry, and study the utilization of this force in its various phases,—in cataphoresis, in the use of instruments and engines, in the therapeutic application of this force in many ways. This should not be left out of the course.

Neurology is a very important study, I believe, and should come in the fourth year. I have to congratulate the president on this address. I think it is very able, very timely, and I feel that he has selected a proper subject for our discussion.

Dr. W. C. Barrett. What is the object of *dissecting?* Is that to be considered a special study? Is it our aim to teach students how to dissect, or is that but an adjunct, like the study of a bone in the study of anatomy? Do we study anatomy to learn how to dissect, or do we dissect as a part of our study of anatomy? If the former, practical anatomy should be at the close of the course and a senior study. If the latter, it should begin our study.

Bacteriology. I think this should be put in the third year, because it requires the consideration of so much of physiology with something of pathology. Bacteriology is an advanced science of great importance, but its comprehension requires much preliminary study. Hence it should be a senior study.

Surgery. We do not teach surgery to dentists as we should. Dentists are not surgeons; they do not take the surgical view of their operations. If the average dentist has to extract an impacted tooth, he goes to work with a pair of forceps, and there will not be one out of ten who will adopt any surgical measures previous to the attempt at extraction. Instead of laying the tissues bare and exposing the tooth and bone to view, according to surgical procedures, he is too apt to begin with a pair of forceps and gnaw and gnaw until he has gnawed off all the tooth that is exposed, and then he quits. We do not teach students to take a surgical view and to adopt surgical procedures. We hear a great deal of loose talk about surgery. There sometimes are state examinations on surgery from men who haven't the first conception of surgical procedures, and who never served time on a hospital corps in their lives.

Comparative anatomy. I think that should lie at the bottom of all our elementary instruction, and comparative dental anatomy, especially, should be an absolute essential. Some of you know that I have taken considerable interest in this work. When a very competent writer took it up and was invited to prepare a text-book for schools I laid it down. I have lately begun work again. What I shall produce is more than I can tell. But, gentlemen, we have not given sufficient attention to many things that should be basal subjects, and one of them is comparative anatomy.

Dr. J. D. Patterson. From whence did you learn that the usual operation of extracting an impacted wisdom tooth was to go at it with the forceps? We don't do it that way.

Dr. Barrett. I learned it by experience, in the first place. In the second place, I learned it by quite an extended observation. In the third place, after I had made some progress in surgery myself, I learned it from some outrageous reference cases that were presented to me in the course of my own practice.

Dr. W. E. Grant. I was unfortunate in missing the president's paper, but have heard enough to know that the turn of the discussion has taken to the consideration of the curriculum. I am very anxious to say something on the subject of anatomy, especially of the dissecting course. My observation has been that there are hardly two schools in this association that work along the same lines in the anatomical laboratory or the dissecting requirements. There are some schools, I am informed, that allow the student to complete his didactic work, and even issue certificates passing him on anatomy, before the student has been in the dissecting room. A great many schools allow the student to complete his anatomical course in one year,—devoting to the practical course time varying from three to six weeks. We certainly need a more uniform system along this line. I believe myself that a student ought to have two courses of lectures of two to three hours a week and serve two years in the dissecting room; these dissecting courses ought to be of at least six to eight weeks in length, six days in a week, and at least two hours each day. And for the life of me I can't see how a student has completed his course in anatomy until he has dissected. I think we are cheating ourselves financially and we are robbing the student of a very important instruction by allowing him to complete his course in dissecting in one year of two or three weeks and collecting one fee for it.

I commend the suggestion that we should add physics to our course. We have been teaching a little physics in our school and find it very beneficial. And I am also very glad to hear the suggestion that biology should be taught in the schools.

Dr. A. O. Hunt. I am very much pleased and interested in the subject chosen by the president—the curriculum of a four-year course. I think we have all thought over this carefully, and I must say that the arrangement presented to us to-day meets with my approval in nearly all respects, particularly of the work added to the freshman year. I think that if we fail in any part of our curriculum it is usually in the freshman year. Students come from a different order of education into professional schools; they come from a class-room recitation. They are not accustomed to lectures; they are not accustomed to getting the best out of lectures, and it often happens that a portion of the session is gone before a student is really at ease with himself and becomes familiar with the work as it is presented. More than that, the advancement along the lines of teaching in every educational institution in the world has been on the increase. The subject that I wish to talk about more particularly is that of biology. There is probably no branch of study that will be so valuable, so important and useful to the freshman student, if properly conducted. He not only begins to learn to use appliances, but he begins to learn something of the fundamentals of the human family by comparison with other organisms. At one time in my experience it happened that we were not able to get sufficient material for proper dissecting and we were put to the severe test of finding a substitute. At that time the dissection of dogs was substituted, and I was perfectly astonished to see the good results obtained from that experience. Further than that, a good laboratory course in biology, such as a student passing through the scientific course of a university gets, prepares him for the work coming after much better than anything that I am familiar with, and I desire to thank the president very much for his arrangement of studies for a four-year course, and especially for the introduction of biology.

Dr. A. E. Webster. Not being a manager of a dental college I do not look at the formation of a curriculum from the same standpoint that some other men do. The statement has been made once or twice that the curriculum should be formed so that it might be uniform and students might move from one school to another. That is a very poor basis. There ought to be some basal principle on which to arrange this matter. It is best to teach anatomy either the first or the last year, and it should be put in *that* year because it is the proper place to teach anatomy. We should base this on some kind of pedagogics first, not on convenience.

Dr. G. V. Black. It is apparent that the teaching of dentistry has not yet crystallized into permanent form. We are making history; we are making an effort to get at correct principles of the presentation of subjects which develop a knowledge of dentistry. It will take years yet to get this properly placed. I should be very glad to see the subjects proposed in this curriculum written out and then presented, or a sufficient number of copies made, and that each man who has thought along this line write a statement following each one of these, as to where he would place it and the time he would give it. The subject of bacteriology may be well placed early in the session, if it is simply biological bacteriology. It may come toward the end of the term of pupilage if it is pathological bacteriology. It depends on *what* is to be taught as to the time at which it should be placed. And so we might state of various other things. We have been spending considerable time in the discussion of this subject and I want only to enter these suggestions. This is a matter that we must meet in the very near future in the arrangement of the four-year course, and as Dr. Webster has well said, it should not be arranged for convenience simply, but on a logical basis of the presentation of these subjects to students.

Dr. J. D. PATTERSON. I appreciate what Dr. Black says, that this matter of a final settlement of the curriculum of dental studies is not yet crystallized, or may not be for many years. It seems to me that we have gone at the matter in the wrong way. Instead of requiring that the young men who come to us to study dentistry must have had a certain amount of preliminary education, we have increased the number of terms and have gone at the matter of crystallizing this dental education in the wrong way. In 1896 some of us were very sanguine that we had commenced dental education in the right way when we outlined a course to pursue, demanding higher equivalent for entrance, and we were happy. Then, I believe when we were at Old Point Comfort the next year, we killed, I might say murdered, those good resolutions and went back to where we were in 1893 and 1894.

I challenge anyone going through the schools and testing the capacity of the students to say that what I state is not true, viz, that entrance requirements are about as in 1893. What is the use of discussing uniformity of methods of curriculum as long as we do not have uniformity in the material to which we are to teach dentistry? My belief is, as has been so clearly set forth by Sir Michael Foster, that the foundation of dental education must commence with a broad base and finally reach up to a cone, and the point of that cone shall be the future dentist. After two or three years of university study, then commence toward the dental cone; the allied sciences, the study of biology, histology, physiology, and on up until we come to the strictly dental studies, which need not be four years of seven months each. So I say that we have gone at it in the wrong way, and until we get the basis in the receptive ability of our students, what is the use of talking about uniformity? It seems to me that is rational, and I want to impress upon you that we must go back to the better plan of advanced entrance requirements instead of increasing the time of study. Let us, every one of us, if we have not done so already, commence from this day to insist upon and work for a higher entrance qualification, and that entrance qualification shall stand for work in the allied sciences which afterward will point up to, and make, what we believe is the perfect dentist.

Dr. E. C. KIRK. I had not intended to discuss this matter, but the remarks of Dr. Patterson have stimulated me to say something. I am heartily in sympathy with his protest against saddling these elementary preliminary studies upon the dental educational institutions. It seems to me that the preparatory school should deliver to the dental school suitable material upon which to base the superstructure of a professional education. I regard it as an outrage that we have to teach elementary physics; that we even have to teach elementary chemistry. There is no study which is of greater general utility than a knowledge of elementary chemistry, and it should be made an obligatory study in the preparatory schools. The professional school should be concerned only with teaching the application of these fundamental principles to the needs of the professional man. I am heartily in accord with the idea of teaching applied physics, but it seems to me that the preparatory school is the proper arena in which to teach elementary physics as the foundation upon which to erect our superstructure of physics as applied to dentistry. I want to say something very carefully, and I do not wish to be misunderstood about it. A great deal has been said here to-day about the teaching of anatomy. It seems to me that the one thing that has characterized the medical curriculum from the beginning has been the importance which is attributed to a knowledge of anatomy. It has been the one central subject a knowledge of which has characterized the professional man in medicine. Naturally this is so, because if we look back through the history of medical science we see the immense benefit which the study of anatomy has conferred. But I ask the question, Have we not somewhat over-magnified its importance? I ask you in all seriousness, Does not the medical man, does not the dental man have more daily, hourly need for a correct knowledge of pathology and therapeutics than he does for a knowledge of anatomy? How many teachers in this room feel that they could go before the professor of anatomy in their own college and pass a creditable examination in that subject to-day? I admit the practical use of anatomy, but I don't want to overestimate its value. It seems to me that a correct knowledge of pathology and therapeutics is of infinitely more value to a professional man than an equivalent knowledge of anatomy. Of course, a knowledge of bacteriology, physiology, chemistry, and subjects of that character are intimately correlated with the knowledge of pathology. Let us have all the anatomy that is needful for our purpose, but let us not give it an undue proportion in our dental curriculum.

I want to say something about the four-year course. There has been large provision made in the suggestions here offered for the study of biology, chemistry, surgery, neurology, and some other desirable things, but may I ask, Where is dentistry coming in in connection with all these new additions to the curriculum? A knowledge of electricity in dentistry would be desirable. I was wondering why you didn't suggest photography and radiography also. Dentistry is specializing rapidly. Take such a subject as orthodontia; it is now almost a distinct dental specialty, we now have a special organization of teachers who are developing that important department. But that does not represent the knowledge of orthodontia needed by the average man. So it seems to me in teaching the subject of orthodontia we should give to all of the students in a dental class an average amount of instruction in orthodontia,—we should have the principles of the subject of the etiology and the therapeutics of malocclusion of the teeth generally inculcated; but you all know in your experience as teachers that during the progress of the course men develop certain tastes, certain inclinations, and it seems to me that it should be a specific function of the fourth year to give to those men an opportunity of higher instruction in the branches in which they are by natural inclination specializing. All dentists are not alike. We cannot cast men in molds. Every man in this room has his specialty of some sort. Dr. Barrett is asking for better instruction in comparative dental anatomy. That is all right, but I am not sure that every man would agree with him that a knowledge of comparative dental anatomy is one of the essentials of a dental course. I would therefore suggest that the fourth year of the curriculum should furnish opportunity for the training of men in purely dental elective studies. I marvel that something has not been said regarding giving men a thorough course in physical diagnosis. I think that is of more importance than biology, at least than the kind of biology that has been here alluded to. I would like to say something about freehand drawing. Why should we give dental students a special course in freehand drawing? It is a very good thing in itself, but for the ends of dental education should not be confined to the drawing of geometrical figures, but rather to the delineation of work in dental anatomy. In other words, we should, in our educational system, begin at the beginning, as Sir Michael Foster has said, with the idea simply and definitely that we are going to make a dentist. And I will agree with you to make the base just as broad as possible, but let our educational system tend to *make dentists*—first, last, and all the time.

Dr. N. S. Hoff. From what you have just heard I trust you are beginning to realize that you won't have much trouble in filling a four-year course when you come to it. I have had a little experience in devising a curriculum for a four-year course, and it pretty nearly downed me before I got through with it. I hadn't worked at it very long before the question was not as to whether we had enough to put in the four-year course, but where we were going to put what we must incorporate in a course designed to equip students for the practice of modern dentistry. When you come to putting in the things that are necessary in this course you will find that you have not time enough. You will not be troubled about how much biology you are to teach, or how much padding with correlated sciences or arts which have no direct bearing on the practical work of the course, may be necessary. If you add to your curriculum only such studies or courses as are necessary from the technical aspect, you will find that you have enough of these practical subjects, and more than you can possibly teach in the four-year course. That is the experience that I have had, and I want to simply drop it in here. Don't be afraid that you are not going to have plenty of things to put in, for I can assure you that you will have to cut out many things that seem very desirable.

Dr. Geo. E. Hunt. It will take a very few minutes for me to close this discussion. If Dr. Stubblefield by his intonation suggests to the student the reply that he desires, he is not a good examiner orally. I have over twelve hundred questions which cover my course in operative dentistry through the three years. I have had those questions printed and the students can get them. There are about four hundred questions for each year's work, and if any student is able to answer all of those four hundred questions correctly that is all I want to know about his theoretical knowledge. In examinations you should try to find out what the man knows, and not what he does not know. If I find he is informed on a subject, I drop it and go to something else.

In regard to this curriculum, I had no idea that we would come to a conclusion to-day. In fact, the hair-pulling has been so limited that I have been a bit disappointed. I thought it would excite more discussion than it has, and would be much pleased to see a committee appointed to report at our next meeting regarding the ideal four-year course.

SYMPOSIUM ON THE EXECUTIVE WORK OF THE FACULTY.

EXECUTIVE WORK OF THE FACULTY.

BY E. C. KIRK, D.D.S., PHILADELPHIA, PA.

I SUPPOSE that the object of this symposium is to bring out an expression of views as to faculty work and the management of the course of instruction in dental schools. The school with which I am connected is a department of a university, and is therefore subject to the general university management. I presume that the simplest way to give you an idea of our management would be to read to you from the statutes of the trustees, which are the laws of the university, that portion which relates to the management of affairs in the dental school. Those regulations are as follows:

"The officers of each faculty shall be a dean and a secretary. The dean shall be elected annually by the Board of Trustees, and the secretaries by the several faculties."

(I may say with regard to that by-law that all of the officers of the University of Pennsylvania are elected annually or re-elected annually, which is a provision made by the trustees so that in case a man may be found unfit for service for any reason whatever, he may simply fail of election. It is a protective system on the part of the university that provides means for closing out the contract with any officer or teacher after one year.)

"The provost shall appoint a dean *pro tempore* in the case of absence or inability of the dean or of a vacancy in the office. The dean of each faculty shall in the absence of the provost preside at the meeting of the faculty, appoint standing committees of the faculty, and shall call meetings of the faculty when he deems it necessary, or upon request in writing of three members of the faculty. He shall be the official organ of the university between the faculty and the provost, and through him communications may be presented to the faculty.

"He shall have a general oversight of the instruction given in his department; he shall be charged with the government of students, and shall enforce discipline. He shall be considered an officer of the Board of Trustees, and shall be directly responsible to the board.

"The deans of the several faculties shall have the care and supervision of the buildings and grounds appropriated to instruction under their several faculties, unless otherwise ordered by the Board of Trustees. The dean shall enforce such care and supervision through such officers and servants as the Board of Trustees may provide.

"In any faculty a sub-dean may be appointed by the Board of Trustees to do general work belonging to the dean's office under the direction of the dean, as may be advisable and the board may direct. The dean shall approve all requisitions for supplies for his department before they are submitted to the provost.

"The secretary of each faculty shall keep the minutes of the meetings of the faculty, preserve papers, lay before it and conduct such correspondence as it may direct."

The meetings of the faculty are called largely for the purpose of consultation, and for the purpose of securing an harmonious adjustment of the several elements of the curriculum. As everyone, I think, who has had experience in the management of college affairs will admit, each teacher having charge of a department becomes more or less impressed with the idea that his particular department is the most important one in the curriculum, and we find it necessary, when so many are imbued with the same idea, to get together and consult with reference to an adjustment of the relative proportion of time and energy which shall be given to each department of the curriculum. That is one object of the faculty meetings. Another object is the outlining of a policy with regard to the rules and regulations which shall govern the conduct of instruction, the question of rules for admission to advanced standing, for advancement in the course, rules affecting graduation, and so on. These rules having been established, it then becomes the function of the executive officer of the faculty, the dean, to see that they are properly carried into effect. I may say that the tendency in the University of Pennsylvania, with respect to all of its departments, is to enlarge from time to time the power of the dean in the management of the department. That may at first sight appear to have the objection that it is likely to make the dean an autocrat,—that it may develop a tendency on his part to enforce his individual ideas; but, on the other hand, there is ample provision for relief from anything of that sort by the by-law of the Trustees providing for the removal of the dean or anyone who is likely to become obstructive in that or any other way. So I think that in the general management of the faculty affairs, where the dean is in harmony with his faculty, the more the power of the dean can be enlarged with safety, the more smoothly will the department be managed.

There are a great many questions that it is impossible for the faculty as a whole to act on promptly, and a dean being in harmonious accord with the members of his faculty, and having a closer relation with the student body than any other single member of the faculty, is perhaps in a better position to take prompt action with regard to any new matter which might arise than he would be if he had to call a meeting, or if he had to submit the case to a committee or go through a lot of red tape before action could be taken. In other words, I would make the plea that the power of the dean be enlarged as much as possible within limits of safety, and that his faculty should stand in a consulting relation to him, so that in any case of necessity he may have the benefit of their advice, but he should be as unhampered as possible in the general management of the department.

Now with regard to the distribution of work. We regard each member of our faculty as practically supreme in his own department; that is to say, what he shall teach is a matter of his own election, and how he shall teach it is also a matter of his own election. But he subdivides the educational work with the instructors that are provided for his assistance in his particular department, and we try, as far as possible, to make each head of a department, both the member of the faculty and the chief demonstrator under him, responsible for the smooth running of that department. The organization is analogous to a military organization, so that in case of irregularity or discipline in any department the dean does not deal with the individual student until after he has had the assurance that the case involves something that the instructor has found himself unable to adjust.

The suggestion which was given to me in regard to this symposium was a very general one, and I have endeavored to put before you the way we manage our affairs as nearly as I could in accordance with that suggestion. I don't know that I have anything further to submit on that point.

The PRESIDENT. Do you have regular meetings of your faculty, and do you experience any difficulty in having the members attend these meetings?

Dr. KIRK. We find a necessity for calling occasional meetings of our instructors for the discussion of just such problems as come before this association, as to methods of teaching. For example, I recently found a difference of opinion existing among certain instructors as to the proper method of taking impressions of the mouth in plaster of Paris. I found that one man was imbued with one set of ideas and certain other men with another set of ideas. There is one thing that we insist upon, and that is that whatever differences we may have among ourselves, they shall not be presented to the class. So that when this particular difference of opinion arose I simply called together the men who would in the course of their work of instruction be required to take impressions or give instruction in taking impressions, and by conference that matter was adjusted at once. So that occasions of that sort may arise where we bring a group of instructors together to study out any difference of opinion that may occur.

We have regular times for faculty meetings and seldom have any trouble in having all the members present.

EXECUTIVE WORK OF THE FACULTY.

BY J. D. PATTERSON, D.D.S., KANSAS CITY, MO.

IN my remarks this morning in discussing the president's address I stated that in order that uniform executive methods shall be followed we must have uniform ability on the part of the students, and I do not wish to repeat what I said upon that point.

I think that Dr. Kirk is perfectly right in allowing the dean to be an autocrat. If the dean is not an autocrat, I would not want to go to his school. If a dean does not know his specific duties, we can't inform him. If he understands not his specific duties, I should advise that faculty to get another dean. I have found that the dean must be an autocrat, and I have been fortunate in that I have been allowed to be an autocrat. I go along in a way which I consider about right, and we get along very nicely. I don't believe that all of these questions that are suggested,—Do you have regular faculty meetings? How do you secure attendance by the professors? the lectures filling up their time, and How to prevent one lecture from encroaching upon the subject of another lecture, are quite up to the dignity of this body to discuss, for the reason that the environments of each individual faculty must decide upon what the methods of that faculty shall be. We are supposed in our college to have faculty meetings once a month, but I assure you in the last four or five years there have not been more than three or four faculty meetings during the whole term, because we didn't need them; not that we slighted anything by not having these meetings, but what's the use of having meetings unless there is something to discuss? and, as Dr. Kirk says, when there is anything of importance they are all there.

So far as our lectures are concerned: Five years ago I adopted the plan of every man getting a certain amount of money for every lecture, and if he is fifteen minutes late the hour is not filled. That is the way to settle that question, and I assure you that within the last three or four years our record shows very few misses in this regard.

It has always been a question and a quarrel among faculties about one professor overlapping and encroaching upon the field of another. Now, my candid opinion is that it does not make any difference if they do. So long as what is said is correct, what hurt if it be repeated? The competent lecturer would scorn to be strictly confined within certain limits, and so long as he does his own work well, let him invade other territory once in a while if he enjoys doing it.

These questions are very simple and should be left to the individual faculty.

EXECUTIVE WORK OF THE FACULTY.

BY D. R. STUBBLEFIELD, M.D., D.D.S., NASHVILLE, TENN.

Mr. President and Gentlemen: First. What are the specific duties of a dental college dean? From the very nature of the case it is almost if not entirely impossible to give a correct answer to this question. Colleges differ as individuals, and the controlling influences that limit the duties of the respective deans in the one case are very different from those that operate in another. Holding the mirror up to nature, if I may be permitted, suggests to me to say that the duties of a dental college dean consist of everything that is to be done about a dental college except what he can prevail on somebody else to do, which is just as little as possible.

Historically considered, a dean was a presiding officer, and his presidency was primarily restricted to *ten* individuals, as its etymology indicates. As colleges do not limit the number of their faculties to ten the name is etymologically obsolete.

The old English idea added to that of presiding officer the duty of conducting the religious exercises of a college faculty. This also is obsolete, in America at least,—unless this deponent is wofully out of date himself. We see, then, that the idea of presiding officer, with sundry other duties varied and extended by the special environment, is about all we have left in the term. The specific nature and extent of these obligations must be varied by the nature of the bonds that bind any faculty together. Faculties, like some other joinings together, are not always harmonious throughout, and incompatibilities, as well as other incongruities, are sometimes in evidence. Such conditions would modify the special duties of the presiding officer. Again, if the college was virtually a stock company partaking of the intrinsic nature of a commercial enterprise, that would necessarily modify the special duties of the dean. The specific duties, therefore, of a dental college dean as presented in this symposium must consist of individual word-pictures by each contributor. If this Institute succeeds in obtaining a succinct tabulation of those special duties from these heterogeneous portraitures it will have great reason to congratulate the committee that suggested the effort.

In the faculty with which I have the honor to serve, the traditions impose upon the dean not only the central idea of being presiding officer, but he is expected to hold himself responsible for the maintenance of the work in general. He is the nominal head of the faculty, and sometimes he is the head,—especially if there is anything unpleasant to perform. He is the nexus between the department and the university, and to him all official business is referred and all communications are addressed. Within the department proper he is the great It. He is not the janitor, but he is expected to know where the janitor is, to know at all times what he is *not* doing, to know where he is when he is not anywhere, and to be the committee of arraignment for all his shortcomings.

He is financial agent. He must not only collect all fees when the students have money, but must see that they get it when they haven't, and then cover the same into the treasury of the university. He is expected to enroll a large class,—the larger the better,—and to rigidly uphold the entrance standard against sundry iconoclastic predilections exhibited by the average American youth, who deems himself perfectly prepared to study any profession when he has gotten his own consent.

He is expected to prevent all collisions in the lecture schedule, fill all emergency absences at a moment's notice, heal all frictions between his colleagues, and to be able to cordially "hot-air" every lecturer upon sight. He is expected to hear all complaints of students and settle their discontent, to make good students out of youths who have never studied anything but mischief, and to pour oil upon the troubled waters should insurrection come. He is expected to imbue every student with a burning desire to obey rules; to swallow with avidity every vagary, however contradictory it may be, that may be hatched in the amazing incubator of any professorial genius; and to be the father confessor,—mental, moral, physical, and religious,—of every single man. If he is not a demonstrator, he is expected to see that the demonstrators are everlastingly "cocked, primed, and loaded." He is expected to be on every committee of the faculty and to do the work if it is done at all. Indeed, there are times when he seems to be the great modern Ishmaelite, with the hand of all men against him. He is expected to be the most extravagant of men, for he must give more time and effort of mind and body for little honor and less money than any man living outside of a penitentiary. He is less to be envied than a man with a boil on his nose, and more to be pitied than the poor devil whose only assets are a mortgage and a mother-in-law. The only bow of consolation that spans the dark horizon above his cheerless existence is the living conviction that any hereafter will be heaven to him. "If that be treason, make the most of it!"

Second. Coming, now, to the second interrogatory, we find it is asked, "Do you have regular meetings of your faculty?" And a second section: "If so, how do you secure regularity in attendance?"

Regular coming together of those engaged in a work so complex and so important as instruction should present itself as an absolute necessity. To get inspiration from the suggestion of a colleague, and to get the bird's-eye view of the whole work which is afforded by a full and frank discussion at a faculty meeting, is indubitably of the most uplifting character. With us it is deemed right, expedient, and eminently fitting to hold such meetings, and we publish on our lecture-card a regular monthly faculty meeting.

As for the regularity, that's another story! We intend to have it next time, every time; this is not only a hope, but a solemn conviction. To this end our flag has been nailed to the masthead. As to methods of expediency, we confess we wavered between the alternatives of the old debate question, "The fear of punishment or hope of reward." Therefore, to this question we beg to "report progress."

Third. The third interrogatory reads, "How do you secure promptness and regularity on the part of your lecturers?" That, also, is a poser. We have an unwritten law that the man who habitually lags is suffering from an incurable mental obliquity or desires to throw up his job, and the law operates. We cannot pay munificent salaries, and therefore one of the essential requisites for co-laboring with us is a keen, forcible desire from within to do the work and to look above the plane of mere money compensation. We sometimes have to almost resort to hypnotism to get them, but we have not failed so far.

Again, the force of example is urged. Punctuality is not only expected and urged, but it is acted out to the letter by him in authority. The class is taught to expect it, as well as hold themselves up to such requirement. Enthusiasm is kindled by timely attention to the propriety and necessity for "getting what you are paying for, under the Constitution of the United States."

Fourth. We come now to the last question as set forth by the honorable committee: "How do you avoid covering the same ground by two or more chairs? For example, the anatomy of the face by the chair of anatomy and that of operative dentistry, or inflammation by the chairs of pathology and operative dentistry."

This is dead easy. We don't try to avoid it, for several very good reasons. First: no two coverings emanating from different sources are ever identical. They may be and certainly should be similar, but they are supplemental reciprocally and help to deepen each the impression made by the other. Second: These cross-firings must necessarily occur, but the aim of the one differs so much from that of the other that they should not suggest interference or waste of time. For instance, the anatomist must *cut up* each portion of the organism to establish the structural differences and completeness of the parts. To clearly set forth this completeness of parts he must show to a certain extent the function of each part. But *function* is the special field of physiology. On the other hand, the physiologist must establish the fitness of the structures to elaborate function, giving the anatomy in brief of each part or organ to prove its ability to functionate. But this clearly trenches upon the domain of the anatomist.

No; as we have already expressed it, let each be supplemental reciprocally, helping instead of hindering, and enabling the corps to feel that the work done, not *may* be understood but *must* be comprehended. We must realize that there are certain fundamental parts and subjects and fields of scientific exposition which can never be too familiarly known, too thoroughly presented, too frequently repeated. It is in our work as in nature: The landscape spread out before us is a wonderful composite of varied interests. The farmer goes over it, and he estimates it according to its fitness for cultivation; the geologist sees only the outcroppings of valuable or valueless deposits; the landscapist sees only its fitness or unfitness to evince the lines or colorings of beauty; and the botanist goes over the same ground admiring or deploring the flora. And in like manner we believe each branch of our work presents individual claims which must forever demand special consideration, though springing from and associated with much that is common to all. No; we do not try to prevent intelligent repetitions, for at best we cannot hope to teach everything.

EXECUTIVE WORK OF THE FACULTY.

BY T. E. WEEKS, D.D.S., MINNEAPOLIS, MINN.

I DID not prepare a paper, for the very reason that I expected that what has happened would happen,—that much that I would say has already been said, and that repetition in this case would scarcely strengthen the point. I believe that the dean of a faculty should be in a measure an autocrat. I believe that the holding of office for one year and the reappointment of dean and faculty is a safeguard which will protect the interests of the faculty. I believe that the dean and the faculty should, if possible, be harmonious, and a man who can't be harmonious with his fellows had better be gotten rid of. The question I think can be answered in one sweeping statement, that if there be harmony, if the dean be the proper man to preside, to direct, and to be the autocrat of his faculty, the man to whom his faculty can look up, all these other questions will take care of themselves.

I should differentiate between faculty meetings, executive faculty meetings, and schools of instruction; I believe that a school of instruction for instructors is a necessity in a faculty because we have no normal school where dental teachers can go to fit themselves for their life-work. Consequently, they must receive that instruction from the men in the faculty who have had experience. It is for the benefit of the new men who are fitting themselves to teach, that we should have such meetings. I believe that these meetings would be beneficial if the head of each department would give a syllabus, with more or less explanation, of what he presents and how he presents it, for the guidance of the rest and for the prevention of any unnecessary overlapping.

Now, to overlap is inevitable, but there are two kinds of overlapping,—that which is necessary and that which is unnecessary,—and if each lecturer knew what was being presented by the other he would give only such overlapping as was necessary. We found it avoided friction to have each professor, or head of department, outline his work to the others, as each man gained some strength by the discussion which followed. For instance, the professor of operative dentistry gathers the instructors under him at various intervals and goes over his work with them, and in that way he is certain that the instructors under him carry out his ideas, and no man should be a professor unless he is able to have ideas that other men carry out, and no man should be a professor who is not willing to accept good suggestions from his assistants and associates.

Now in regard to the executive portion. I agree with Dr. Kirk's suggestion that it is a military organization, and in a way, a business organization. We cannot separate the business methods or the military methods from a faculty if we expect that faculty to be successful, but at the same time I don't think it ought to be necessary to enforce a military *régime* in a faculty upon the men who serve with and under the direction of the dean. I think that every man in a faculty ought to have that within him that will make him willing to do the right thing, and I think that every dean ought to possess such qualities that everyone under him will be willing and anxious and will love to do the right thing.

DISCUSSION.

Dr. Geo. E. Hunt. Our method is an elaboration of Dr. Patterson's method. Our professors, from the dean down, are paid for their lecture work so much per lecture, and they sign a contract for a year's work, and in that contract they agree to forfeit the amount of money which they would receive for two lectures if they miss one lecture and the hour is not filled. They may fill the hour with any other member of the faculty, but if they are scheduled for ten o'clock and they are not there, and the hour is not filled, they forfeit two hours' pay. With that method in vogue we lost one hour last year and have lost none this year. I would recommend it to those of you who are having any trouble with the filling of hours. The student is entitled to as regular attendance on the part of the faculty as they require of the student.

Dr. H. A. Smith. All this is very interesting indeed. Just a word in reference to the attendance of the faculty. I think it largely depends on the habits of the dean himself. If he is a prompt man, his faculty will imitate him in that regard. I know of a faculty, recalling the time when I first engaged in this work, and it was an exception when the faculty came on time. Let me tell you how I attacked one of the professors. He was never known to be on time and he was always claiming that he was delayed by a case of obstetrics. Word came to me one morning that this professor was not in attendance,—the first dash I had at him. I started immediately for the college, and about thirty minutes after time I met him going to fill his hour. I said, "It is too late for you, but I will give you the credit of good intentions this time; but hereafter if you are not punctual I will tender your resignation to the trustees at once." And I meant it, and it was said that I was the only man who had ever brought him to time. So the dean must be prompt himself and be at his post to see that his faculty are there.

Now in reference to the demonstrators. The demonstrators should be required to report when they come in and report when they leave. You can do as you please in reference to their salary. I think the New York College deducts from their salary every minute that they miss. That is one way of keeping the demonstrators up. But the dean is the responsible person. If he is not a prompt man himself, he cannot expect it of his colleagues.

Dr. J. H. KENNERLY. These matters brought up so forcibly by Dr. Kirk and Dr. Patterson are matters which ought to have proper consideration, and yet, owing to the fact that Dr. Kirk's school is governed in one way and Dr. Patterson's in another, it is a very hard matter to formulate rules for the government of both. For instance, Dr. Kirk stated that his school is governed in the same way that my school is governed. The individual management of the school itself, of course, is left to the dean and his assistants, whoever they may be. And I am of the same opinion as Dr. Kirk and Dr. Patterson, that the dean needs in some particulars to be an autocrat; no question about that. We have adopted a plan this year that seems to have given us a great deal of help. In the first place, previous to the beginning of the present term, we were compelled to secure new material for our faculty on account of the resignations of some of the former teachers. The trouble we found when the work began was to unify the methods of the teachers and demonstrators. For instance, you take the professor of operative dentistry, who naturally covers the preparation of cavities and the filling of teeth; unless he and the man who teaches operative technics thoroughly understand each other it will be impossible for those men to work in harmony. We finally decided that every two weeks we would hold, not a faculty meeting, but a meeting of the lecturers, professors, and demonstrators, and discuss the different methods of teaching so as to get the demonstrators exactly in line with the teachers. We have found that this method enables us to do very much better work, with much more satisfaction to the students and to ourselves, than could have been done in the old way of letting every man go as he pleased.

So far as faculty meetings are concerned, we have no regular time for such meetings, save two meetings a year, which are specified. We have two members, one the chancellor of the university and another a member of the Board of Overseers, who are members of our faculty, and knowing that they are exceedingly busy men we do not care to take up their time by calling faculty meetings every month. We hold our faculty meetings when we deem it necessary, and when there is anything of interest to talk about we have no trouble in getting our faculty together. We have followed this method so far this term with very satisfactory results, particularly the calling together of demonstrators and teachers to discuss the different methods of procedure in the daily course of instruction.

Dr. W. H. WHITSLAR. There is one question that has not been spoken of very much, and that is the relation of the professor to the student. The main purpose of all of our work is to make good dentists, and in order to do that we must have a unity of purpose between professor and student. If we teach the students that they are not there to play, but for the purpose of education, then we produce in them a desire to learn, and when we treat them in that manner we use them as gentlemen and not as animals. Then we are able to promote that sort of enthusiasm that makes it the height of their ambition to become good dentists. There is one way in which we can produce that result, and that is to say to the students: "You can appoint a committee, if you please, from your class, of one or two, and if anything occurs between you and the professor, if the professor is derelict in his duties, report it to the executive officer and we will try to arrange the difficulty and make it satisfactory to you." Now, some professors may be very obtuse in their methods, and the class are not satisfied with the amount of instruction they are giving. This committee reports to the executive officer, who has a plain talk with the professor and committee, and thereby promotes a better feeling between the officers of the college and the students, ultimately producing better instruction. Ofttimes things occur which the executive committee or officers of the college know nothing about unless they hear of it through some student or committee.

There is another factor which comes properly within the limits of this discussion, and that is the moral relation between the professor and the students. We are not required, I believe, to look after the moral deportment of students, yet at the same time we are so much interested in them that it is a part and portion of our goodwill toward them that we exercise a condition in ourselves showing to them that we are trying to be gentlemen, thus setting an example that they will try to follow. One of the greatest advantages is the personal relation that exists between professor and student. They will return in after years and thank us for the good influence which we exercised over them.

Dr. G. V. Black. I have very little to say as to the general executive work, except with reference to instruction, and not much about that, except some things that seem not to have been spoken of. It is often necessary that the instructors in different chairs, and especially in related chairs, understand each other better than they would without coming together and discussing their mutual relations in presenting their particular subjects. If they do not do so, under the present state of things, their overlappings upon each other will become dangerous because not done in harmony. Now, mind you, the difficulty is not that they overlap, but that they overlap in such a way as to do injury. For instance, I found my anatomist and histologist and physiologist naming the coats of the intestines differently, each one presenting them under different names and dividing them into a different number of coats, destroying the harmony between them. You will see at once that this is a proper subject for all three, and yet to present such a subject properly it is necessary that they understand each other sufficiently well so that they will present that particular thing similarly to the class. Such things as this occur all through the school work. We must overlap upon each other, but we should have such an understanding, teacher with teacher, that this overlapping will be done in such a way as to strengthen the work of each instead of injuring the work of all, as it did in this case. Now, in this case I considered it necessary to call the attention of all three men to that fact, and have them come together and discuss their mutual relations and arrive at an agreement as to nomenclature, not only upon that particular subject but upon other subjects upon which they might differ,—for we may follow the literature of the subject very perfectly and disagree diametrically in the nomenclature of these things. This is simply an illustration of what it is necessary to do with a corps of teachers who are presenting the subjects that we teach. It will not only occur at this particular point, but it will occur at a great many points. Any corps of teachers in a school should agree on a system of nomenclature and understand each other as to the nomenclature used throughout the school.

I agree with Dr. Kirk that any particular subject should be under the charge of one person. For instance, operative dentistry should be under the charge of the professor of operative dentistry, from the beginning in the freshman class in operative technics to the end of the third year or to the time of graduation, and every teacher in that department should be in a degree under his guidance as to what is taught, how it is taught, etc. It should be the same in prosthetic dentistry, and in other departments. This question of setting certain men to do this work without any guidance at all is wrong, in my estimation. The whole of this work should be unified, harmonized, and guided by a central power. As to the demonstrating force, it should be the same. I have for years made it a rule to have my demonstrating force together once a week, sometimes twice a week, delivering a regular course of lectures, often consuming a large part of the year, keeping them along with the work that is being presented to the students, maintaining harmony between the action of the different demonstrators and between the action of the demonstrating force and the didactic work, so that it all moves in a unit. It seems to me that there is no other logical way of presenting these subjects to students. We not only in the operative department but in the prosthetic and other departments as well, recognize the head of those departments as the person to whom we should go if anything goes wrong.

As to our faculty meetings. We have faculty meetings once a month and the principal work in these meetings is the discussion of methods of teaching, the presentation of this subject or that subject, and we have no difficulty about attendance at faculty meetings. Our teachers are interested in the discussion of these subjects. Each teacher presents from time to time his methods, etc., and it becomes an interesting school of pedagogics for the benefit of the school. Our faculty meetings are distinct from our demonstrators' meetings, always.

SYMPOSIUM ON CLASSROOM METHODS.

CLASSROOM METHODS OF TEACHING.

BY N. S. HOFF, D.D.S., ANN ARBOR, MICH.

NOTWITHSTANDING the fact that the strictly didactic methods have been employed for so many years, and with such pronounced benefit, the popular idea at present seems to be centered on the objective or laboratory methods. This is particularly the case where methods of thinking and working are to be developed *de novo*, as in kindergarten work with children, or the newer sciences of biology, such as bacteriology, for instance. And these methods, for quite similar reasons, have been found the most useful in imparting instruction in the more distinctively technical branches of the medical and dental curricula. We are confident that all who have had much experience in teaching dental classes will value these methods highly, even if they do not deem them essential, in the purely mechanical or technical subjects. We have, however, come to the conclusion that it is unwise to confine the methods of imparting technical instruction entirely to the laboratory methods, and believe that didactic principles, if not methods, have an important place in presenting these subjects to the mind as well as to the other perceptive senses.

As my paper must be brought within the compass of ten minutes I shall not be able to further elaborate this statement, but crave your indulgence while I refer to my personal experience, from which I trust you may be able to draw some conclusions which may be helpful in verifying or in changing your present methods.

When I was a student, and also when I began teaching, prosthetic technics was taught as a purely mechanical art. The instructor was called the "professor of mechanical dentistry." This condition remains unchanged in many schools at this time, although most generally the instructor is now a *prosthetist,* and a separate department of prosthetic technics has charge of the purely mechanical branch. Formerly the student attended the lectures on mechanical dentistry and spent so much time in the laboratory, constructing, with the aid of a demonstrator, such experimental work as his conception of the principles given in the lecture course would permit.

After a short experience with this method I came to the conclusion that it was unsystematic and perilously faulty, and besides, the time given up to the laboratory part, at least, was not wisely spent. A change was made in the method which promised to remove at least some of the objectionable features. This involved the separating of the technical from the didactic instruction and the placing of the technical course under separate instructors and its more systematic development as a purely technical subject while at the same time it should be made to harmonize and, so far as practicable, co-ordinate with the lecture course on the principles and art of prosthesis.

To briefly outline the course, with which most of those present are doubtless familiar: Models which would best illustrate ideal cases were prepared, representing in a systematic gradation all the more useful prosthetic appliances, and from these metal casts were made from which students might secure a uniform set of models for the construction of the plates and other appliances of the course. Each piece of work was then taken up consecutively and presented to the class in all the details of construction by means of a class demonstration, without discussion of its art or practical significance, but with all necessary comment needed for its mechanical construction. Each piece of work was constructed before the class in accordance with one method only, with slight comment on other methods which could be sanctioned or on some which it was thought wise to condemn. The idea was that if the student could see one good method successfully demonstrated he would be able to copy and retain it. My experience with this method has not been without criticism. It has accomplished practically what it was designed to do, and in a fairly satisfactory manner; it has not developed a mechanical genius where only a poet or fiddler was planned by the Creator, neither has it succeeded in circumventing the designs of the indolent or incorrigible, or any other impracticable thing. But I have succeeded in presenting to the class in an experimental way a very satisfactory amount of technical work, practically covering the entire field, in a reasonable amount of time and without increase in equipment or instructors.

There have developed in the trial of this system certain shortcomings which it seems to me might be very well made good by slight modifications of some of the methods used. I find that many students, while conscientiously following the technical instruction, have learned to follow the copy so closely that they have forgotten to cultivate personal initiative, and so when brought face to face with a practical case not resembling in most details conditions with which they are already familiar, they do not seem able to even apply processes which they have learned very well indeed. I am not sure, however, but that this result is inevitable with any system.

Another result, which while perhaps not so serious is one which is quite annoying and a great hindrance to the highest attainments, is the fact that students are apt to look upon technical work as *task work*, and so perform it in a perfunctory manner, while occasionally an unprincipled or thoughtless student will maliciously abuse your confidence. It may not be practicable, by any means, to frustrate the designs and purposes of such students, and it may not be wise to modify well-conceived and practicable methods in the hope of compelling lazy students to do their duty or unprincipled ones to do right; yet it would seem that any means which can be employed to such an end would not detract from the work of interested students, and might serve to still further increase their enthusiasm and love for the work.

For the purpose of correcting the first criticism, and to give the technical work a more artistic if not practical bearing, and of removing the seeming objection that it is an altogether elementary and mechanical task, I have this year added some features to the instruction which I hope will correct this tendency and at the same time not detract from the value of the course as a method of cultivating hand-craft. I have sought to introduce only such work as should have a direct influence in the cultivation of technique, but which at the same time would appeal to and draw out the dormant talent, whether technical or artistic, and demand more or less mental co-operation.

After the first work in the technic course has gotten fairly well started,—and this work consists in taking impressions with wax, compound, and plaster, each student taking the impressions from his bench-mate, and pouring the impressions in plaster,—two or three class hours are devoted to a consideration of the surface anatomy of the mouth, especially the teeth and gums, and the occlusion of the teeth. This is done by lectures and quizzes upon the teeth, the students having for reference the plaster models which they have made, introducing as much of the nomenclature as may be necessary to make descriptions intelligible. The result of this is to first cause the student to make a more careful examination of the mouth of the patient or chum for whom he is at work. He becomes more familiar with the form and markings of the teeth and gums, and at the same time he notes discrepancies and strives to obtain more perfect models. The value of a perfect model in all prosthetic work is continuously kept before him while he is engaged in this work. As soon as this work has been satisfactorily completed each student is given a natural incisor, bicuspid, and molar tooth, as nearly sound as it is practicable to obtain, and he is asked to carve a tooth from a block of plaster of Paris as near the form as he can and with all markings, but magnified about five times. I was quite gratified at the interest developed by this exercise and also surprised at some results obtained. From this exercise I have gained a considerable insight into the intellectual and artistic capacity of each member of the class. To still further test this artistic capacity and to develop the more mechanical side of the technical subject, I next devised a combination steel wax-spoon and carver, with such lines and angles as would not only test but train and develop mechanical abilities. A drawing of this instrument with measurements was made and a duplicate copy furnished to each student. The instrument was then made before the class in demonstration from bar steel, every step, including forging, filing, finishing, tempering, bluing, polishing, and burnishing, and the finished instrument placed in the laboratory where it could be inspected and measurements verified. The rounded curves and definite angles and sizes proved a somewhat serious task to some, but the final result was on the whole quite satisfactory, as the interest and enthusiasm created quite compensated for the time devoted to this work.

These exercises have served to give me a better knowledge of the mechanical conceptions and possibilities of this class than was possible by any other means; and this knowledge will enable me to present the more practical technical subjects which are to follow in a way that will draw out these same resources to the best advantage. This result, too, has been obtained without losing the confidence or interest of the class, and the work has been done in such a way that no student could shirk it and report a result to which he is not entitled.

The future work of the course will be confined to plate crown and bridge technics, and, as it follows somewhat closely the lecture course in prosthetic dentistry, there will be more opportunities for the introduction of interesting or practical incidents which will claim the attention of the students. I am planning to show before the class cases from the clinic which will illustrate the application of the various methods taught in the laboratory course. If by such means I can retain their attention and interest, I am confident that the results will be shown in a higher grade of technical skill on the part of the worthy students, and such as have little natural ability or lack of capacity for acquiring it will be easily and unquestionably found out, making it possible to discourage them from the further pursuit of a calling in which hand-craft is such an important factor. For this purpose no other course in the curriculum is so well adapted, and anything which can be added that will make it possible to get more light upon this subject will be worthy of consideration.

CLASSROOM METHODS OF TEACHING.

BY ROBERT H. NONES, D.D.S., PHILADELPHIA.

How best to teach dentistry so that the greater number will be both interested and benefited is a much more difficult question today than in former years, due possibly to the increased number of students, and greatly on account of the addition of many more theoretical and scientific subjects. The purely theoretical lectures will not meet the requirements. It would seem that the lectures were almost supplementary to the clinics and demonstrations, so much benefit being derived from the latter.

One individual could hardly give a proper recognition to the entire course and at the same time systematize both lectures and practical demonstrations so that the perceptive, intelligent student could be as advantageously instructed as his weaker classmate. But the combined thoughts of many, collected from careful observation and association with the student, naturally would be the best method of solving the problem.

Careful systematizing of methods, division of classes into sections as well as thorough instruction of demonstrators, instructors, and lecturers by the professors of the various chairs, always maintaining a very close and friendly relationship between professor, instructors, and students, permitting absolutely no barrier between them,—the one thought being entirely, Who can best benefit or be benefited, and how?—is the first step toward a successful result.

Why were so many of the older practitioners such successful dentists? Principally, because of their tutelage under preceptors who commenced with them at the bottom of the ladder, in laboratory work, and by practical observation and appreciation gradually made them masters, not only of the mechanical aspect of the piece in hand, but gave them as well a thorough knowledge of the make-up and use of the materials, tools, appliances, etc., of which and with which it was made. The learner became so familiar with dentistry at the bench that operative dentistry came as a natural consequence, and he could almost teach himself; in contrast, I might say, with the desire of many who have entered upon the study of the profession in later years (beginning at the top of the ladder!), to work at the chair and gradually go downward toward the foundation. Such a course is rarely successful toward the making of a thorough dentist. As a general rule the student who attempts to learn the operative branch first, at the sacrifice of the prosthetic, rarely becomes a good mechanic; but those who begin at the beginning,—the bench, with all its pleasant or unpleasant surroundings, according to the man,—contrary to the mistaken idea possessed by many who begin where their tutors left off with fashionable practices, almost invariably become good all-round dentists.

Those of us who have seen the past method of teaching, when the student usually entered a laboratory for a few years preparatory to college, cannot but question, Are we to-day making as good practical men, or do we sacrifice some of the practical for the theoretical? It is a matter of grave importance not only to teachers but to the coming generation of dentists. We must at this enlightened day have theorists; how much, if any, of the practical side can be sacrificed, or what happy medium can be reached? is the problem.

If all the colleges were so fixed financially that applicants could be received or rejected at the judgment, say, of the teacher or teachers of operative and prosthetic dentistry, I unhesitatingly affirm that the successes would be more numerous and the failures less, because they would naturally select students endowed with mechanical instincts, and who being thus armed would be better prepared to acquire theory.

What chance would a prospective student have who had never as a boy driven a nail, sawed wood, or made his dog a house? Given students with mechanical ability, we can make dentists; without it, failures. We may be mistaken, however; manipulative ability can be acquired, but it is the exception rather than the rule.

How best to teach in colleges having crude untrained material, with, in many cases, absolutely no instruction from preceptors, in order that many, instead of a few, may be benefited, will tax the brain of the most experienced teacher. One assuredly feels, however, that if started with a proper foundation and agreeable surroundings, the work will not only be interesting, but a pleasure to perform. So in teaching, the student at the beginning should be brought to a thorough knowledge of the laboratory and its equipment, not only theoretically but practically, the instruction never being entirely by lectures, but rather the reverse as far as possible,—by practical demonstrations.

The lecturer cannot get too close to the student, in fact he must be demonstrator as well as professor. Greater interest is retained by not leaving the practical side entirely to the demonstrators or assistants. The student should be thoroughly taught theoretically how it is done, and practically how to do it.

Sectioning off classes cannot be too strongly commended,—strengthening the student where weak, and making him stronger in those points which he seems particularly able to grasp; also advancing the capable and holding back the tardy until proper proficiency has been attained; but the advancing of the student from one step to another before he is thoroughly trained should be condemned, although to give him proper encouragement is very essential.

I have had increased success by following up lectures on prosthetic dentistry, within the next day or so, with demonstrations, the students duplicating as closely as possible the work performed,—all requirements being personally made before the student, giving him much better instruction than it is possible to obtain from lectures, or from finished or partially finished work on models.

Too much praise cannot be given the lantern method of teaching in all branches in which it is practicable, and it *is* possible to some extent in all. In order to realize how much students can be benefited by this method, we have only to reflect how much better we grasp the words of a speaker when able to see the subject placed in a picture.

To set aside part of the lecture-hour for quizzing will be found to be advantageous not only to the student, but to the teacher as well, giving him an opportunity to find out whether his teaching has been clearly and correctly understood, and to set right those who may have misunderstood or who were not clearly impressed.

Many of us forget that it is impossible to make our subjects too plain or simple for the comprehension of the general student body. We are too apt to talk over the heads of our listeners; we should always endeavor to have each individual leave the room feeling that he has been benefited in at least one point.

The teacher who has the ability to draw, and thereby illustrate his lectures or talks with sketches, can not only clearly impress but interest his class, as well as hold their attention. This method is much to be preferred over that of presenting old diagrams brought out year after year, and which have become monotonous to both teacher and student.

The more demonstrative are the teachings, the better the students are able to grasp them, and the more enthusiasm displayed by the instructor the greater will be the interest of the class, particularly in those subjects which so many feel have no direct bearing on dentistry.

A systematic course of lectures, each followed as far as practicable with clinics and demonstrations, will be productive of much good; as, for example, in operative and prosthetic dentistry each lecture should be followed with clinics or demonstrations,—the chair of pathology and therapeutics affording an excellent opportunity for sectioning off the class for practical demonstration in the infirmary of the college.

Surgery offers a course, particularly with work upon the cadaver, which is not fully appreciated; the students should assist in and perform such operations as are calculated to be of special interest to the dentist.

In anesthesia and anesthetics they should not only be shown and assist in the actual demonstrations, but be allowed to perform the various methods; in this connection a thorough course on physical diagnosis, with practical demonstrations in which the student should take part, will do much to correct the ignorance displayed on this subject, and protect patient and operator as well.

So with the various other subjects,—practical demonstrations, close association between the instructor and instructed, encouraging and enthusing the student to a thorough conception of the truth that "What is worth doing is worth doing well."

With the coming four-years course an opportunity will be afforded the teacher for a still more thorough course of demonstrations, and the way opened for the better teaching of particularly the practical branches.

CLASSROOM METHODS OF TEACHING.

BY L. S. TENNEY, D.D.S., CHICAGO, ILL.

THE problem of classroom teaching is one that has received a large share of the attention of this body, for next only in importance to the question of what studies should constitute a complete dental curriculum in order to afford the most thorough and efficient course of instruction is the problem of presenting those subjects in the most effective manner and in a way that will result in the broadest development of the student and best fit him for the demands of his work.

In a paper so limited as this I cannot attempt other than a few random thoughts, and as a teacher in the operative department of our work it is proper that I should confine myself to that subject.

The laboratory method of instruction is a development of recent years, and is rapidly finding a place in nearly every department of our college work. In materia medica, anatomy, physiology, and bacteriology not only is a large amount of illustrative material now made use of, but more actual laboratory work is required of the student than ever before.

We need hardly discuss the merits of this method of teaching; its value is too obvious, and it has become too fully recognized by us all. It is to-day, and must ever remain, the most important feature of our educational system; and the only question is what proportion of our time may be justly allotted to such work. Operative technics, occupying as it does a most important position between the theoretical and the strictly practical, and connecting the two, should, in my opinion, receive a larger share of our attention than it does at the present time.

In the use of these terms, however, I wish to say that I was much impressed with the position taken by Dr. E. C. Kirk in a paper read before this Institute a few years ago, in which he took exception to the common expression, "practical and theoretical," when applied to dental teaching. He contended that our course embraced no subject whatever, if I understood him correctly, that could not be regarded, in its broader sense, as practical. And yet the long-established custom of designating studies as practical or theoretical, according as they relate or do not relate directly to technical procedures, has fixed rather a clear line of distinction between them; and it is in this sense only that I use these terms.

But with reference to the teaching of operative technics, I feel that we not only do not do full justice to the subjects now embraced in this course, but that other and most useful ones should be added. We are to-day carrying this teaching but little farther than we did when the course was first introduced, although it will be admitted that our methods have greatly improved since that time. That we have kept it within its present limits has been to a great extent a matter of necessity, since the length of the college course would not permit any material broadening in the scope of the work; but when a four-year curriculum shall have been inaugurated, that curriculum should include an advanced course in operative technics.

If I were asked in what particular the work should be enlarged upon, I would state that in my opinion we should not only require more extensive experimental work with reference to the character of all structures operated upon, and the physical properties of all materials employed in these operations, but that the proper place to teach first-year operative dentistry is not in the lecture-room, but in the laboratory, where lectures upon this subject might be amply illustrated and be supplemented by laboratory drill.

To me, this method of teaching operative dentistry would appear to be the logical outgrowth of our many years of thought along the lines of technical training, and, in the light of past experiences, the time seems ripe to transfer this whole subject from the lecture-room to the laboratory until the student has mastered all the technical details possible and is prepared to enter directly upon his infirmary practice, thoroughly trained in every phase of operative work. Limitations it must have, since laboratory practice can never take the place of practice upon the living subject; but in the former there is still opportunity for much improvement, for we have by no means developed as yet all the possibilities of training of this character. Mere knowledge of detail, however, is not the only benefit to be derived, for in the laboratory only can the student acquire that manipulative skill that will enable him to successfully prosecute his infirmary work; and to this end his technical training should not only be made more thorough and comprehensive, but should immediately precede infirmary practice. I can make only this brief reference to the matter, however, and hope to hear some expression from you in the discussion of these papers.

On the subject of laboratory teaching in general, I wish to say that to me there has always appeared to be a tendency on the part of the student that we must early endeavor to correct,—a tendency tc do his work in a mere imitative way. If, for example, he is preparing a cavity in a tooth-form, he follows the demonstrator closely, observes his method, inspects the cavity he has prepared, and, having noted its exact position, its form and its dimensions, proceeds to copy it with little or no thought of the principles involved. He works by rule and subordinates principle to mere detail.

That method of technic training is most effective which teaches principles and then encourages the student to reason out their application. Every opportunity possible should be afforded for self-instruction, since all authorities agree upon this to-day as being the most rational system of education. The very character of our work demands originality in thought and action, and our efforts should be constantly directed toward its development. A student should follow his demonstrator intelligently, but not blindly; he must be guided, but should not merely imitate. Self-reliance should be encouraged from the start, knowing, as we do, that his future success will depend largely upon his own individual judgment. The reason for every step and the principles involved should be made most emphatic. To know why cavity margins should be beveled, and why cavity walls should be extended, is of vastly greater importance than the mere technique of those operations. Not that I underrate the necessity of exact technical training; but, once get the underlying principles implanted in the mind, and any man can solve the problem of detail for himself.

Again, since the knowledge we acquire through our own experiences and through scientific investigation is of the greatest and most permanent value, more time should be devoted to work of this character. All other methods of teaching are fast giving way to that more rational system where knowledge is based not on the statements of accepted authorities, but upon carefully determined scientific facts. Indeed, we have long recognized and are adopting this system, although we are not as yet giving it the attention its importance demands; and it is along this line that we ought to enlarge on our laboratory work. The field is wide and the opportunities would appear almost unlimited.

Gold in all its forms should be studied experimentally; the conditions necessary for perfect cohesion, the effect of impurities illustrated, its behavior under pluggers with serrations of varying depth; tests applied to determine density and resistance, together with experiments illustrating clearly the results of imperfect adaptation. The study of amalgam should be carried on in the same practical manner, showing its tendency to change form, with subsequent tests for leakage; the right proportion of alloy and mercury, with tests for density and edge strength. The study of cavity preparation should be most exhaustive and largely experimental in character, illustrating the mechanical laws involved, determining the degree of resistance offered by fillings, and demonstrating the various methods of instrumentation.

In short, this method of experimental teaching should in a large measure supplant all others, for it is evident that a student possessed of the knowledge thus acquired has a clearer conception and a firmer grasp of the facts than he could possibly gain in any other way. He is brought to realize clearly that exact scientific knowledge must be the basis of his work.

In the consideration of teaching methods it would seem proper that I should call your attention at this time to a new feature in the construction of the flexible rubber dummy. The introduction of this dummy marked a distinct advance in our technical work, offering as it does possibilities scarcely thought of before. The dummy as presented here to-day does not differ materially from those presented at previous meetings by Dr. Webster, Dr. Byram, and others, aside from the method of obtaining the vulcanite teeth.

In a number of colleges the method practiced heretofore has been to require each student to carve a set of teeth in vulcanite or other suitable material; and while not wishing to be understood as criticizing the work of others, I will state that my own experience has been that the carving of these teeth involved the expenditure of too much time and effort, and offered too many technical difficulties, to be practicable. That the carving of a full set of teeth would be an excellent training no one would deny, but the question arises as to whether the results secured would be in just proportion to the time required. We are endeavoring to make our course as thorough and comprehensive as our time will permit, and we must not devote too much attention to any one feature at the expense of others of equal importance. The carving of four, or at the most, six teeth, therefore, is all that I have ever felt justified in undertaking.

The problem of securing molds in which teeth might be vulcanized was suggested at our last meeting by Dr. H. J. Goslee, and since that time the matter has been taken up by Dr. C. F. Bryant, who after repeated experiments and discouraging failures, finally produced a set of molds with the results as shown here to-day. These teeth, finished and ready for use, are now furnished the students at nominal cost. They are then arranged in wax and the model properly carved and covered with heavy tinfoil, after which the case is flasked, packed, and vulcanized. I have adopted this method in this year's course with the most satisfactory results. Out of the entire class there has not been a single failure in the construction of the dummy, and a wide range of demonstrative work has been made possible.

In the early part of anatomy teaching I hold frequent but short written quizzes, requiring that all note- and text-books be laid aside, but allowing the students to converse freely. We all know how timid the beginner is in the use of technical terms. This method familiarizes him with the use of such terms, inspires confidence, and for this purpose, if for no other, has proved helpful.

Instrument-making is limited to about a dozen or fifteen typal forms, feeling that with the present length of the course anything further than this would require the outlay of too much time.

In ivory carving we use no measurements except the outer dimensions. As the piece begins to assume definite form the calipers are discarded and the characters of the tooth are judged by the eye alone.

In the teaching of cavity preparation, after discussing general rules and requirements, and when some practical work has been done, I suggest the position and approximate outlines of a new cavity, and then require each student to prepare such a cavity with nothing to guide him but his own conception of what its form should be. It brings out a discussion of principles as nothing else will.

The work of the course should be arranged and classified with reference to its bearing upon the more closely related subjects, with the view of employing as many methods as possible to illustrate each subject considered. Carving should be done during the teaching of anatomy, and root-canal technique should immediately follow. Instrumentation should begin with cavity preparation and be continued along with it. System and intelligent arrangement is of the utmost importance, and should be observed throughout.

DISCUSSION.

Dr. ELLISON HILLYER, opening discussion. I do not understand from any of these gentlemen whether or not they have found it advisable to divide the class distinctly. Dr. Nones has spoken of it, but I do not know that he does it. We in New York find it very advisable with a large number of students to divide the class into distinct sections and by this means—in classes of from ten to twenty—the professor and his assistants are able to take each man individually and follow with him each particular step. The difficulty of which Dr. Hoff spoke, that of students having their specimens made by someone else, or by someone outside, has been done away with entirely by the system of cards which we have in every class and in every section. These cards have upon their back, as I remember, a full list of the steps in all the work, and on the face a place for the student's name and section, with corresponding numbers to the steps on the back and as each student finishes a step he has to have his card and the one which the instructor holds, which is a duplicate, punched together.

The matter of demonstrating coincidently with the didactic work we have followed, at least in my department, by having such work demonstrated at the lectures. The personal attention to the students is what we have been most anxious to bring about, and seems to have been accomplished by dividing into sections.

Dr. W. E. GRANT. There is one point that I wish to especially emphasize, which we have used in the Louisville college, and that is the suggestion of the advanced operative technics course, and as the colleges are about to advance to the four-year course we can probably use it to better advantage than in the past. We have a course that is required of the junior students, covering about thirty to thirty-six hours, in which they review much of the work of the freshman year, as juniors, just prior to their going into the infirmary. Those of you who have not tried such a course would be very much surprised to see the results,—how poorly even those students that were well advanced as freshmen understand operative procedures when they return to you as juniors, especially if they have been out of touch with dental work during vacation. This course puts a student to task to show you how much better he can do his work as a junior than he did as a freshman, and some of the operations required of him in the freshman course are also required of him in the junior course, and he is criticized and graded very carefully on these operations. This course is very beneficial, and I think some of the technic teachers who have not tried it would be delighted with it after a trial.

Dr. T. E. Weeks. I want to support what Dr. Webster said last, or rather to modify it a little by calling the attention of those of you who were at the Columbian Dental Congress to the discussion of Dr. Cattell's paper. I made the statement at that time that the technic of the dental engine should be taught at the same time that the technic of other instruments was taught, and I believe it now more firmly than then. What would you think of a carpenter who compelled an apprentice to cut a mortise with a chisel without the aid of an auger, and why do you refuse the student the use of his dental engine on his technic work and compel him to do it with hand instruments? Why should he not learn the technic of the bur and the handling of the handpiece at the same time he learns to handle a chisel and excavator?

What I wanted to detail was an experience we have had in converting the infirmary for several afternoons into a classroom, for an infirmary drill for students who had successfully completed their operative technics and were ready to be admitted into the infirmary. There are still some things that a student has to learn, else he is awkward and embarrassed in the reception and handling of the patient,—namely, the reception and seating of the patient, the adjusting of the chair to the patient, the examination of the mouth, the adjustment of the napkin, and the use of the mouth-mirror and exploring instruments. The first operation that a student is permitted to perform is the cleansing of the teeth, after the examination. First, he is required to examine the teeth and note on a blank the operations necessary; second, to cleanse the teeth thoroughly, remove all calcific deposits, and thoroughly polish the teeth. Then there is another operation which is very important, and that is, the adjustment of the rubber dam. We divide our class into one and two, or A and B, as you please. Mr. A takes Mr. B and receives him as a patient, seats him, adjusting the chair to his comfort and to his own convenience; examines his teeth with the aid of the explorer, the mouth-mirror, the floss silk, the glass of tepid water and syringe, and notes on the blank the condition of Mr. B's mouth. When all of the Mr. A's in the class have completed this, Mr. A takes the chair and Mr. B does the same thing for Mr. A. Then Mr. A cleanses Mr. B's teeth, and in turn Mr. B cleanses Mr. A's teeth. Then they apply the rubber dam in at least three different positions. They are taught to measure the rubber dam, how much rubber dam to use, where to put the holes, how far apart to put them, the value of floss-silk ligature for carrying the dam into position, and the value of twisted ligature for retaining it in position over the floss silk; where clamps are necessary, and where they are unnecessary; under what conditions it is necessary to have a retaining ligature, and under what conditions it may be dispensed with. The teacher of operative dentistry and all of his assistants are in the infirmary during this drill, so that there are enough teachers to instruct and watch each student to see that he correctly performs the task. And we find that when the students approach a patient they do it much more intelligently.

Dr. H. C. Kenyon. I believe that the teacher should come into close contact with each student and that the person who gives the didactic instruction should, if possible, be in the laboratory to assist in the demonstration. I am especially interested in operative technics and I have been particularly interested in Dr. Tenney's paper. My method of teaching is to use the usual laboratory methods in the preparation of cavities, carving of teeth, and making of instruments and teaching of instrumentation; and I find that it is quite advisable to give what I call a laboratory lecture,—a short talk of perhaps not over fifteen or twenty minutes at the beginning of or some time during the laboratory period, and I expect to keep to the subject immediately in hand for that particular afternoon. Sometimes I make an outline explanation, using the blackboard, and illustrating on models. I make a thorough explanation of the work that is required, and then I see each man personally and help him to carry out the instructions, and I think that I have been more successful with this method than when I have to depend upon giving the lectures at one time and the demonstrations at another. You tell students from the platform what you expect them to do in the way of making a technical piece, and there are so many small details that their minds will not carry them for any length of time; so I think it is very important that the student should have a clear, concise outline lecture and demonstration of the work and then that you go directly to him and assist him,—I mean, to point out his errors and make corrections in his work and guide him in the construction of it. I have used this method, and so far I am very well pleased with it.

Dr. A. E. Webster. I have had a great deal of pleasure in listening to Dr. Tenney's paper. I do not wish to discuss the subject to any extent, but I desire to draw attention to one thing to show the difference between didactic teaching and laboratory teaching, I mean in efficiency. I have taken about forty men into a room and shown them as definitely as possible how to wind cotton on a broach, explaining it as explicitly as I could, and then allowed them to try it. It is surprising how many men will fail to thoroughly grasp what was said. I have often made a wager with a class and said, "Well, I have just demonstrated this to you; I will find twelve men out of the forty who cannot do it." Now, if twelve men out of forty cannot do it, how would you expect them to remember it for a year, as is the case in some colleges.

The other point I want to draw attention to is in the advanced operative technic work. Last year I drew attention to the use of engine technic. I want to say again that it is just as essential for a student to have engine technic as any other kind. Think of sending to a patient a student who has never handled a handpiece. This may be done, and should be done, just previous to his entering the infirmary, so that a student may make the very operations in the technic department that he is called upon to do in the infirmary. The operation that he has to do the next day for the patient he may do in the technic department, using the flexible models that have been referred to.

Dr. D. M. Cattell. I would like to know what Dr. Weeks, or anyone else, would think of the foreman or boss of a box factory who would put an apprentice to work at making a box with dovetailed joints the first thing he did when going in, or at that character of work before he learned how to drive a nail or make a common, plain box with saw, nails, and a hammer. Now, it is all right for that apprentice to learn how to make boxes with dovetailed joints, but not until he has learned how to drive a nail with a hammer. Expert work is not done with unskilled hands.

Dr. T. E. Weeks (Replying to Dr. Cattell). If I had brought in one classifying phrase that I neglected to use, my eloquent friend would not have made that speech. The use of instruments should be taught sequentially, and I did not think it necessary to make that statement to this body of men.

Dr. V. E. BARNES. In my college training, both in the technical and dental schools, it seemed to me that the students are not brought to understand the relation between their technical and their practical work. The one does not merge into the other, *i.e.* a man is set to work to make a fine technic plate; it is fine as a technic piece and there it stops. Then he goes into the clinic and is asked to make a practical piece. He can do the technical part, but knows nothing whatever of the fitting of that piece to the mouth. It seems to me that with the soft rubber dummy we can more closely imitate nature than in any other way. Prosthetic pieces can be constructed on these dummies and then be fitted to them. Here the use of the dental engine should be taught, for surely the student should understand its use before experimenting on a patient with it. As a student, trained in a college and under a preceptor I must say that the college training was technical and the preceptor's was both technical and practical.

A word on making the soft rubber models. When I first made them I was surprised what a field they presented in teaching dental anatomy, for I learned a good deal of it before the models were finished. By using natural teeth in plaster molds, the hard rubber teeth thus obtained are somewhat crude and need carving and polishing a little. This I believe is just enough to give the student a good idea of the tooth it represents. When these teeth are finished they can be mounted on the soft rubber base on which the technic pieces can be made and fitted.

Dr. T. E. WEEKS. I attended a meeting of the Minneapolis Educational Association and listened to a paper by a teacher of manual training; there was one point in it that struck me as being of direct practical utility to us as dental teachers. Possibly some of the rest of you have experienced the difficulty of having one or two bright men get through their technic tasks before the rest, and it upsets the course badly to allow those students to go on to the next step before the rest are ready. He obviates this difficulty by selecting an extra task that the brighter men may do, and it is rather an incentive to all of the class to complete their work quickly. I will explain it by describing a windmill which was being made. The teacher would not allow each man to make a windmill, but he allowed the men that got through to make certain pieces of the derrick; then each man made a vane for the windmill, and the best one was used to be mounted on the derrick, which was the combined effort of all the class. It struck me that we might utilize this idea by having some advanced pieces of work or extra pieces of work that the students might do, and they would be proud and glad to get through their work in order to perform this extra piece of work.

MANAGEMENT OF THE INFIRMARY CLINIC IN DENTAL SCHOOLS.

By G. V. BLACK, M.D., D.D.S., Sc.D., LL.D., Chicago.

In the consideration of the management of the clinic of a dental school we should have a clear appreciation of what is to be accomplished, and of the natural or artificial hindrances to its fulfillment. The object of the infirmary clinic is the education of students in the practical features of dental practice. Every arrangement of whatever nature should be made with the view of contributing to that end. In doing this, however, many side issues come in for consideration that will not down without serious evil to the educational interest, and that must be worked out in such a manner as will, all things considered, best conserve the interests of instruction. One of these is the financial interest. At the present time the income from the clinic is regarded as essential, probably, by all of our dental schools. Having said this much, I shall not discuss the matter further except as to arrangements for the incidental collection of these infirmary fees.

Another matter in this connection that might well be the subject of a separate paper is the arrangement of the course of instruction in operative and prosthetic dentistry with mutual reference to the didactic and the clinical instruction of students. It is in this that many of our dental schools are lame. But as other things are expected of me in this paper, I cannot now stop to discuss it further than to say that the whole of the teaching of either of these departments should be under the control of one person from the beginning of the freshman year to the close of the senior year. I do not mean by this that one person should do all of the teaching in either of these departments; but I do mean that one person (or, it might be, several in consultation) should plan all of the teaching in either department and have constant jurisdiction over the progress of the work in all the grades, to the end that the teaching in its plan of presentation be a continuous whole. No one teacher should use a different nomenclature from another. No one teacher in the lower grades of operative or prosthetic dentistry should teach anything that will be dropped as superfluous in the next class, nor in a manner that will not be followed by the next teacher who takes the class. This holds good in all respects whether the teachers be few or many, whether the students be few or many, and includes the demonstrating force in each department; no matter if this force be composed of one person or of many persons,—all must act as nearly as a unit as possible in order that the best results may be attained. All of this is necessary to the best results in the infirmary clinic; especially is it necessary that the demonstrating force be so trained in their work that they may follow closely the didactic instruction.

With these statements I shall leave this part of the subject, and proceed to that which seems to have been more especially set apart for the subject of this paper: The *management of the infirmary clinic with reference to its records.*

One of the first things now to be considered is the legal status of the college student in the clinic. In the legal sense the student has no rights in the practice of dentistry except as he is directed by instructors who have acquired that right. His instructors stand to him in the position of legal guardians of all of his rights in practice. Therefore the student can do nothing in practice, legally, without the direct oversight of his instructors. This is true of the student in the office of the practitioner as well as in the school. This point being conceded, the first care will be to make such arrangements for the infirmary clinic that every patient comes first into the hands of an instructor for the examination of the case and the first direction of the student in its treatment. From this point to the final discharge of the patient each step of the operations performed must be under the guidance of the instructors. This is just as necessary in the educational sense as in the legal aspects of the case, also for the reason that the student is to receive instruction upon point after point as he proceeds. The whole arrangement of the clinic must be made with both these ends in view. These should provide for a *record* of each step in the procedures in such form that the whole can be brought in review at any time after the operations are completed, showing that this guard has been kept in each individual case. This kind of guardianship is necessary in the legal sense for the protection of the school in case of any suits for malpractice in its clinic. If this care is clearly shown the courts will be very slow in finding against the school; but if, on the other hand, it should appear that this care has not been exercised, such a case might easily result in heavy damages against the school; for the decision in the case would hinge largely on the question whether or not reasonable care and supervision had been exercised by those in authority. This is also necessary in the educational aspect of the case in order that the education of the students and of each one individually may proceed in a systematized way, and be guarded at every point. None of this should be left to the memory of either instructors or students, whether the classes be large or small.

What should be the record of the steps of procedure? or at what points in the procedures should records be made? As far as possible these should be selected at natural breaks in the procedures, or where changes are made from one part of an operation to another, and especially points where the student will require other material in order to continue, and to obtain which he must consult his demonstrator. All such points should be made landmarks past which students should not go without consultation, for they are sure to take matters in their own hands and proceed if not rigidly estopped. Take, for example, operations for filling teeth. I should require these. First the examiner determines approximately what filling operations are needed for patients individually as they present themselves, and makes a record of his findings in duplicate upon an *assignment slip*. One copy is filed under the student's number in a filing case kept for the purpose, and the other is delivered to the student to whom the case is assigned with some general directions as to its treatment. In making this assignment the examiner has due regard for the difficulties of the case and of the competence of the student selected to handle it. The possession of this assignment slip is the evidence of the student's right to operate for that patient. With it and the patient he enters the operating room, either at once or at some subsequent time as may be arranged, and also from time to time as may be necessary, for it is not necessary that the patient go again to the examiner.

Having placed his patient in the chair he makes his own examination, comparing his findings with those of the examiner, and possibly chooses his course of procedure for that sitting. Then he calls his demonstrator for advice and is in frequent consultation with him from that time to the completion of the operation. Now, as the demonstrator cannot be always at the student's side, and it is not desirable that he should be, it is necessary that certain stops or hindrances be imposed to his progress past certain points without examination of what he has done, to prevent the student taking matters too much in his own hands. Therefore no material should be obtainable for making the filling except by order of the demonstrator in written form, requiring that he be called for this purpose. Then the preparation of the cavity must be examined and approved, or such changes ordered or demonstrations made as will lead to its approval. Then the student's *record slip* is made out and the approval of the preparation of the cavity recorded with the demonstrator's signature. At the same time an order is made out on which the student draws the necessary material from the office, collecting the price from the patient and paying it to the cashier, and it being receipted for by the cashier by punching the figure from the patient's receipt which is attached to the operative record slip. Note now that the material is drawn upon a special *order slip* that must bear the number of the record slip upon which it was issued. The two must be presented together at the office. The order slip remains at the office and its duplicate with the demonstrator, and from these the financial record is made. The record slip and patient's receipt is retained by the student, with the credit mark for the cash paid upon it. Then he can proceed with the filling with such consultation as may seem necessary. In case large gold fillings are being made it is common with us for the demonstrator to issue but a part of the gold necessary on the first order, so that the student may not escape inspection at a point during the progress of the work, and also because of the difficulty of choosing accurately the right amount of gold.

When the filling is finished the student is estopped from discharging the case until the demonstrator has examined and passed upon it, has graded it and awarded the points credit to the student and made the record on the *record slip*. This amounts to an absolute hindrance to passing the demonstrator at this point, for it is this record slip turned into the office upon which the student obtains credit for the minimum requirement of operative experience in filling operations before graduation. If he discharges his patient without this examination he receives no credit. This should be positive in all cases and without the possibility of evasion. When this is all completed the receipt for the money paid is detached from the record slip and handed to the patient, who is discharged for the day. The record slip is then returned to the record clerk to be recorded on the student's record page.

This completes the individual filling. Every other filling operation is like it except that one assignment is all that is necessary for the consecutively arranged operations for one patient. For this four slips are necessary; and these may be on the personal plan or on the numerical plan, as will be explained later.

The first is the *assignment slip*, which should be made out in duplicate, the examiner filing one under the student's name or his number, and delivering the other to the student. No student is allowed to operate for any patient without displaying this slip, which is the evidence of his right. In every class of a considerable number of students some will be found who do not get along well with their patients, and as a result the latter disappear from the clinic before the work assigned is completed. Such students invariably complain of a lack of patients for whom to operate. In any case of complaint a comparison of the assignment slips filed by the examiner with the credits to the student on his record page will expose the true nature of the difficulty.

The second and third are the *operative record slip* and the *patient's receipt*, which are attached together until the completion of the operation. This record slip is necessary, with the record in due form, from which to make up the student's records of experience in operating, without which in satisfactory amount no student can graduate. This should bear on its face a record of the individual cavity, the approval of the preparation of the cavity, the amount and kind of material ordered for the case, the points awarded for operative experience, the grade of the completed work, and the initials of the demonstrator who had it in charge; all of which will be posted upon the student's record page.

The fourth is the *operative order slip* from which the finance account of the clinic is made up. This is also in duplicate and has consecutive check numbers. One copy is given to the student on which to draw his material, and the other is retained by the demonstrator and turned directly into the finance office at the close of the day. The finance clerk compares these with those on which the students have drawn their material, to see if all has been correctly done and that the cash agrees with the amount the slips call for. We have found this necessary to prevent some evil-disposed students from imposing upon the clinic by collecting from patients, using their own material and putting the money in their own pockets. By this plan any attempt in this direction is at once detected, accurately located, and the guilty party immediately exposed.

The *student's record page* is a page set apart to the individual student in the operative record book. The same book is also used for the prosthetic records, and it is our custom to place the two pages opposite so that opening to one displays both. These pages have ruled columns for each item of credit to the student on the record slips, in which these are posted in full, with the name of the demonstrator having the oversight of each case, etc., making a concise but very complete record of what has been done.

Prosthetic department. The *assignment slips* should be the same for both the operative and prosthetic departments, but the other slips should be different because of the difference in the credits to students, the difference in the material required, and the difference in the plan of collecting the fees in the two departments. To place all of these on one slip so as to use the same for both would make it unnecessarily cumbersome. Neither can the collection of fees be managed in just the same way, for the reason that the student will want material at times when the patient is not present. This makes it necessary that some fixed portion of the fees in this department be deposited at the beginning to prevent loss, and that this be arranged for each case, with the proper record. Otherwise than this, the same principles should control in making out the prosthetic record slips as have been explained for the management of the operative department. That is to say, stops for examination by the demonstrator should be imposed at every natural change in the procedures, whether the piece be a crown, a bridge, or a plate. In the case of an ordinary Richmond crown these stops may be at the time the root is prepared and an order slip is to be made out for the gold for the band; when the band is fitted and the gold is to be ordered for the cap, and the tooth selected; when the tooth is ground to place and the gold is to be ordered for the backing; and the rest on a similar plan.

Each one managing such a department would naturally have his own ideas as to just where these enforced stops for examination and special demonstration should be placed; and I do not know that the placement of these has any special bearing on the general management so long as they are sufficiently frequent to prevent students taking matters too much in their own hands and getting out pieces of such work without sufficient supervision and demonstration for their proper education and the needful protection of the interests of infirmary patients. But it is the duty of every school to see to it rigidly that such arrangements be made as will subserve both these interests.

The particular wording upon the slips will of course depend upon the ideas of the different instructors having the departments in charge; and particularly upon the credits arranged to be awarded to students, and the material that is supplied them by the school. I do not mean that these are matters of indifference, but rather recognize that in the present stage of the development of dental educational methods it is too much to expect that the various dental schools will agree on all of these points. Harmony in these matters is, however, very desirable, and it should be the object of all those interested in dental education to enter into the discussion of these plans with the view to the development of a system that can be generally adopted in dental school work. The cardinal points which I have tried to illustrate thus far may be named as—First, such checks as will bring the student sufficiently often into consultation with the demonstrator to well serve his educational needs. Second, such checks to the progress of the work without supervision as will well protect the interests of the infirmary patient from questionable procedures by students. Third, the keeping of such records of these procedures as will serve to bring in review each individual case at any after time and show to any court of law that the interests of both student and patient have been duly guarded at every stage of the operation. Happily these coincide in such a way that when the one is well done the other two will also be cared for: they are coincident interests. No dental school should do less than this; for this much is necessary to the proper guarding of the education of the student; this much is necessary to the proper guarding of the interests of the infirmary patient, and the records are necessary to show that these have been well done, and to protect the school against damages being awarded in case of suits being brought for fancied wrongs to patients.

Some other records are necessary to render these complete under all of the conditions that are liable to arise in the progress of the work in dental schools. Patients will come with complaints having forgotten the student's name, and no one may remember about the case. Students will occasionally lose their assignment slips, and will have forgotten the name and address of the patient. Patients occasionally come to an engagement having forgotten the name of the student and no one knows whom to call. Indeed, all manner of crooked things will come up that require immediate disentanglement. The best scheme for this is the patient's *index register*, if the personal plan is used, or the patient's index register and the *numerical register*, if the numerical plan is used.

The best patient's index register by far is the *card index*. In keeping this, the examiner writes the name and address of the patient on an ordinary catalogue card, adding the name or number of the student to whom the patient is assigned, and files these alphabetically in the ordinary filing case. During the work of the day these cards may be set away as they are written, and filed in order in the case after the other work is over in the afternoon. When both the name of the patient and the name of the student is written on all ot the slips and on the student's record page, consultation of this index will serve as the key to the whole account whenever the patient's name is known. In case the patient is to be found, the student's name being known, the name will be found either on the student's record page or on the assignment slip filed by the examiner.

This personal plan requires that the name of the student, and the name and address of the patient, be copied from slip to slip throughout all of the procedures, and finally upon the student's record page. It is desirable that this be avoided, and the amount of writing reduced to the lowest amount consistent with accuracy in the accounting; this is best accomplished by the numerical plan. In this the patient's index card is the same, except that consecutive numbers are printed on the cards, and in writing these they are taken from the pack in numerical order. Otherwise the patient's

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REVIEW OF THE SLIPS

NUMERICAL PLAN

INDEX CARD No

ASSIGNMENT SLIP

151

RECORD OF OPERATIONS PRESCRIBED

ASSIGNMENT SLIP

151

RECORD OF OPERATIONS PRESCRIBED

STUDENT'S OPERATIVE RECORD SLIP

Class

OPERATIONS

MATERIALS

TREATMENTS

Northwestern University Dental School
146 FRANKLIN ST. COR. MADISON

C

CHARGES

CENTS

DOLLARS

OPERATIVE ORDER STUB 151

OPERATIVE ORDER SLIP 151

PERSONAL PLAN

ASSIGNMENT SLIP Date

B

Patient

RECORD OF OPERATIONS PRESCRIBED

Remarks

Examiner

ASSIGNMENT SLIP Date

B

Patient

RECORD OF OPERATIONS COMPLETED

Remarks

Examiner

STUDENT'S OPERATIVE RECORD SLIP

C

Case

Patient

Address

Date

OPERATIONS

MATERIALS

TREATMENT

Northwestern University Dental School
146 FRANKLIN ST. COR. MADISON

C

CHARGES

CENTS

DOLLARS

OPERATIVE ORDER STUB

Record No Date Office No. C

Student

Demonstrator

Gold	Bolts
Amalgam	Capsules
Extraction	Anesthetic and Apron
Rubber Dam	Pieces
Scaling	Cement

OPERATIVE ORDER SLIP

Record No Date Office No. C

Patient

Address

Student

Demonstrator

Gold	Bolts
Amalgam	Capsules
Extraction	Anesthetic and Apron
Rubber Dam	Pieces
Scaling	Cement

Date

Date

Student

Case

Patient

Address

STUDENT'S PROSTHETIC RECORD SLIP

Roots inspected

OPERATIONS

MATERIALS

Northwestern University Dental School
146 FRANKLIN ST. COR. MADISON

C

CHARGES

CENTS

DOLLARS

NOTICE

For every order slip improperly made out or illegibly written one half of one per cent will be deducted from grade.

PROSTHETIC ORDER SLIP

Office No.

Patient

Address

Date

Student

Case

Contract Price

Paid Deposit

Paid on Account

Paid Balance

Paid in Full

Remarks

NOTICE

For every order slip improperly made out or illegibly written one half of one per cent will be deducted from grade.

PROSTHETIC ORDER SLIP

Record No Date Office No.

Demonstrator

Gold Plate 18k

Gold Solder 20k

Gold Solder 18k

Pure Gold Wire

Platinum Wire

Platinum Plate

Platinum Foil

Aluminum Plate

Red Rubber

Black Rubber

Pink Rubber

Amalgam

Cement

Beeswax

Vulcanizer

Shade

Ordered

Logan Crowns

Teeth

Teeth

name and address and the student's number only is written on the card as before, and the card is to be filed in the same way. But in this, the number of the card becomes the number of the patient, and takes the place of the patient's name and address on all of the slips and on the student's record page. Otherwise, all of the slips and the student's record page is the same as before; no other change need be made in them whatever.

This plan saves a large amount of writing, for we have found that by the personal plan the name and address of the patient is written from seven to eleven or twelve times for each operation. In the numerical plan it is written but twice, and afterward designated by number. But in the use of the numerical plan, a *numerical index register of patients* should also be kept. This is the ordinary book with the ruled lines consecutively numbered, used by commercial houses that use the numerical plan of book-keeping. In keeping this book the examiner writes the index cards and sets them away as before during the busy part of the day, but before filing them away he copies the name and address upon each card, with the student's number, upon the appropriate line in this numerical index book. Then when it becomes necessary to look up the name and address of any patient for any purpose, the number being known, it is quickly found by reference to this book. I am of opinion that this is the most complete system of book-keeping for the dental school clinic that has yet been devised, and will on the whole best subserve the needs. With this, if any fact is known of any given case, all of the records of the case can readily be brought in review.

I suppose, with many, the question will come, How much of this book-keeping can be left out and still leave a sufficiently complete record? About all I can say is that this question will have to be answered by each school for itself. I know that the records of many of the schools are very incomplete at the present time, and are sadly in need of improvement.

[SEE PLATE SHOWING SERIES OF RECORD FORMS.]

In the management of a dental school clinic there is nothing more important than the collection of fees for operations. These fees, as dental schools are now organized, and with the tuition charged, are necessary to the life of the school, and their collection is managed in as many ways perhaps as there are schools. For the regular maintenance of the clinic there should be one regular system of fees in each department, that should be constant in its application and from which every deviation should be according to a well-understood plan that is constant. There should be absolutely no escape for students who violate these rules.

In my opinion it is best to fix the price of the material used at such a figure as to give an income that is satisfactory, and have no other charges whatever. In this case an order must be written for this material and the cash must accompany it; then no mistake can be made, and no evasion practiced. It is best that those operations which require no material be done free; then if the school sees fit to remit a portion of the fee to its students who become patients, or to needy persons as a charity, let every such case be judged of and done by order issued by some one person having that matter in charge, and by no one else. With us, this is done by a demonstrator designated as "the O. K. man," who writes "free," or a given reduced price, on the face of the order slip, adding his signature. That ends the matter. No reduction whatever can be had in any other way.

I am of the opinion that the arbitrary fixing of prices, so much for this filling and so much for that, without definite rules, should have no place in dental schools. Such a plan will inevitably give rise to the discussion of the matter of the justice of the charge between students and patients, and always to the detriment of the clinic. When the prices are fixed and invariable, such discussion disappears. No one can collect these fees more safely for the school or for the good name of the clinic than the student himself under these fixed rules.

In looking over my experience in the clinic and noting the difficulties in keeping correct records, negligence of duty should take, perhaps, the first place. This pertains to all plans whatever, and the simplification of the plans increases rather than diminishes this difficulty. This is especially true of any attempt to shorten the work by taking near cuts. The difficulties due to the carelessness of students is always with us, and it may be expected to remain as long as we deal with congregations of young men, whether these be composed of dozens or of hundreds. Among these acts of carelessness there is not one that will more persistently entangle the tracing of our dealings with patients than the transfer of patients from student to student without proper record. This will occur most toward the latter part of the session when many of the students have fulfilled their clinical requirements and have a number of patients on their hands with whom they wish to aid their less fortunate schoolmates. Under these circumstances the transfer is all right if done in proper form and so that it can be properly traced. This may be done in one of two ways: First, the patient may be reassigned as a new patient. Second (and this is much the better way), have the first party return to the examiner with his assignment slip, and finding the one of the same numbers in the examiner's file under that student's name, write upon it "*Transferred to No. 00 Sr. class,*" with date; then make out a new set of assignment slips in the regular form, and write upon them "*Transferred from No. 00 Sr. class,*" with date. In this case it is not necessary to make any new index card or to make any new entry on the numerical index book, for in any effort to trace the patient the assignment slip tells the whole story.

In the arrangement of any such system of records it should be remembered that in a well-ordered school the vast majority of cases will be regular in their course and will never require tracing. It is the few irregular cases or the few cases in which there are bad results, that require tracing in order to fix the responsibility or to find out what has really been done. Therefore we should keep the account in the fewest words for the many even if we should have to consult several files or books in tracing the few cases in which this proves necessary; still, we must have such a system that we *can* trace any case.

THE POINT SYSTEM OF CREDITS.

It has been the habit of dental schools to credit students with the number of fillings, crowns, bridges, plates, etc., made, and to require of them that they make some certain minimum number as the sum of their clinical experience before graduation. This I found to be subject to such great abuse by students in the operative department that some years ago I devised the point system to take its place. Finding this to work well in the operative department, it has gradually been extended to about all of the operations of the practical prosthetic department as well. The difficulty found in the numerical count of fillings made has been that students disposed to shirk this work will pick out the easy fillings to make and discharge the patient with the more difficult cavities unfilled. In studying our records on this point some years ago, I found that one rascally fellow, who had passed an excellent examination, had slipped through and graduated having never made a gold filling that required more than five grains of gold. He had adroitly dismissed every patient with the larger and more difficult cavities unfilled, successfully evading the vigilance of the demonstrators, and doing his patients an injury besides treating them dishonestly. I found this to have been practiced to a lesser extent by a considerable number of students. A small filling counted just as much on their credit sheet as a large one, and the less honest students were taking advantage of it instead of trying to make their experience as full and complete as the circumstances would permit. I found that it also contributed to the tendency to use amalgam in many cavities that should be filled with gold, and was doing harm in that direction as well.

Of course I set out at once to break up that kind of evasion of duty, and this resulted in the devising of the *point system of credits.* In this the number of cavities filled is not considered in the credits to students for clinical experience. Instead of this the small pit cavity in the occlusal surface of a molar, the easiest cavity to fill, is taken as the basis of the point. All other fillings are compared with this as to the time required and the experience to be gained, and the number of points increased accordingly. In the application of this plan a regular scale of points is made out for the different cavities, allowing to the demonstrators a certain range of variation for large and small in awarding points; and this is printed each year in the student's book of rules. I append this scale of points:

Value of the Point.

1 point —Ordinary pit cavity.
2 to 5 points—Small to very large occlusal cavity.
3 to 5 " Proximate cavities in the incisors and cuspids.
3 to 5 " Buccal, lingual, or labial cavities (not pit cavities), in the gingival third.
5 to 8 " Step cavities in the incisors or cuspids with restoration of an angle.
5 to 8 " Occluso-proximate cavities in bicuspids and molars, with contact properly restored.

10 to 12 points.—Occluso-proximate cavities, with lost interproximate space from dropping together of teeth at necks, requiring slow wedging, properly restored.

Mesio-occluso-distal cavities will be reckoned as two cavities and points awarded accordingly.

Occluso-buccal or occluso-lingual fillings will be rated as occluso-proximate fillings when there is a similar amount of these surfaces lost by decay.

These ratings apply to both gold and amalgam fillings, with the understanding that no amalgam fillings will be placed in the incisors or cuspids.

Amalgam fillings must be polished at a subsequent sitting. In case this is not done, only one-half the schedule number of points will be awarded.

In any case in which the *contact is not properly restored* with proximate fillings (gold or amalgam), the number of points allowed must be reduced one-third by the demonstrator.

In cases in which from the extension of decay and the loss of walls much building is required, the number of points will be increased in proportion. Otherwise the schedule represents the maximum number of points.

In those cases in which varying credits for small and large fillings are prescribed, the decision of the demonstrator shall be final.

The *points* made represent the experience of the pupil in filling operations. The grade or excellence of his operations will be marked in the percentage of 100.

During four years' experience with this plan it has proved very satisfactory to the student body and to the management. Some others have already adopted it and have reported to me that it is working well. There is no longer any disposition among students to evade the more difficult and tedious operations in order to fulfill the requirements. Of course, any number of points may be designated as the requirement in clinical experience; we have found that the general average is about four and a half points to the filling. We require 75 points from the juniors, and 150 points in gold fillings and the same in amalgams, of the seniors, as the minimum. Students may do as much more as they like.

In the *prosthetic department* the scale of points is arranged as follows,—or in harmony with it for items not mentioned:

Value of the Point.

Repairing vulcanite plate,	4	Plain Logan crown,	4
Partial plate, from 1 to 4 teeth,	3	Shell crown,	6
Partial plate, from 5 to 8 teeth,	8	Porcelain-faced crown,	10
Full upper or lower vulcanite,	10	Banded Logan crown,	10
Swaged aluminum plate,	20	Baked porcelain crown,	10
Watt's metal plate,	20		
Cast aluminum plate,	24		
Gold plate,	30		

Bridges, same percentage per each crown and dummy.

On this scale we require 50 points of juniors and 100 points of seniors. In making these points the student must make a prescribed variety of pieces, but this is made sufficiently flexible to accommodate the kinds of pieces that will usually be presented in infirmary work. It is not considered necessary that each student make the same number of pieces of any given kind. This scale relates only to practical pieces for patients.

THE RECORD OF OPERATIONS.

The plan of record of operations upon charts of the teeth so much in vogue in dental offices is not suitable for school work. We have been using a different form of chart made up of squares, with figures for the upper teeth, and letters for the lower teeth as shown in the following form:

RIGHT.	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	LEFT.
	H	G	F	E	D	C	B	A	A	B	C	D	E	F	G	H	

In this the figures run either way from the central or "*median*" line, and represent the upper teeth. In the same way the letters represent the teeth of the lower jaw. In representing fillings or cavities on this chart a curved line within the square to the mesial of a figure or letter represents a mesial filling or cavity; a curved line to the distal, a distal cavity. A circle within the square represents an occlusal cavity. These figures and letters are supposed to represent the occlusal surfaces of the teeth, and therefore a curved line above a figure, or below a letter, represents a buccal or labial cavity; while a similar curved line below a figure or above a letter represents a lingual cavity. These signs represent the five surfaces of the teeth and indicate the position of fillings. There is no effort to represent either the size or form of fillings.

These letters and figures can be used just as well and with the same certainty of correct representation without the chart, and on any common book in writing. In this we use only the letter or figure representing the tooth desired, draw an upright line on the right or left to represent the median line, and place the curved line in position to represent the filling. In this way we may record a filling in a single tooth or in any number of teeth on the ordinary page in writing or in print. If we wish to record mesial fillings in the upper incisors, we would do it thus, 1) (1. A similar record for the incisors of the lower jaw thus, A.) (A. Or if it is a filling in the mesial surface of the upper first molar thus, /(6, for the left side, or thus, 6)/, for the right side. If it is a distal surface it will be thus, /6), or thus, (6/, or two fillings in the bicuspids thus, /4) (5, or we may place cavities in different sides of the mouth in the same line thus, (6) /4) (5, recording a mesial and a distal filling in the upper left first molar, a distal filling in the upper right first bicuspid, and one in the mesial surface of the upper right second bicuspid. We may also mix together in the same line fillings in the upper and lower jaws without error. This plan brings the record of fillings into very short compass on any common page. It proves to be easily learned by students and is in common use in our school. By the use of this plan we carry the record of every filling made to the student's record page of our record book, and also record the amount of gold used in making the filling. This rounds out and makes our record complete. I can go over the student's record page and learn very exactly what he has done, when it was done, and for whom. This plan also works very well indeed for records in private practice; it is the plan I have used for thirty years, and I would not exchange it for any of the diagram plans.

Maintaining a Clinic.

The plans employed by dental schools in maintaining a clinic, or in obtaining patients for students, have given rise to some controversy and a good deal of criticism. The idea seems to have been general that the school must furnish patients for the class, and that the class itself is not concerned in the matter. The claim has been widely made that these patients must be from the poorer classes who cannot pay the practitioner for dental operations. On this view some of the schools have claimed the right to attract this class of patients by advertisements that would be a discredit to any reputable practitioner, and by so doing have called down upon their heads the severest criticism. I believe that all this is wrong. Our dental schools as at present organized are not eleemosynary institutions; while they should certainly do their proportion of charity work, and in a degree seek that work, they must be made to pay their running expenses. The idea that the school must furnish exclusively poor people for its clinic is a wrong to the student; for this gives him a wrong impression of dental practice. It is a wrong to the school, for if it were literally carried out it would be an injustice to the student body. The plan is wrong because it seems to call for advertisements by the school which are unprofessional, setting an example of wrong-doing before the student body that is in itself demoralizing; for in my observation no school has succeeded in maintaining that kind of clinic without advertising.

I should rather maintain that the student having been recognized as having entered upon the study of dentistry, has by that fact acquired the right to student practice under proper supervision and instruction. Having acquired that right he has the same right to those patients that may choose to put themselves under his care, with a knowledge of the conditions, as the practitioner has. The ability to acquire patients and to handle them successfully is a development that must be acquired by everyone before he can maintain a practice, and every young man should be encouraged to begin this development in student life, and to practice it carefully to the end that he may become proficient as a preparation for after practice. I therefore advise students to bring their associates, who are willing to entrust their operations to them, to the clinic. These people come as patients of the individual student, knowing the conditions under which he is operating. They are examined and assigned to the student for whom they call and in all ways obey the rules of the clinic. Who is there among us who will deny the student this right? None, I hope, for to do so is to do the student an injury. What difference if some of these people are well-to-do financially. Has not the student in the school the right to begin his experience in the management of a practice among his equals in financial and social position,—or the same class that he will naturally seek after leaving school?

Then the student is encouraged to bring his friends to the school. They constitute his best patients; they are the ones in whom he is most interested; they are those for whom he will do his best in operating; they are the persons who will call out the best there is in the student in manner and deportment at the chair; they are the patients who will call out the highest development of the student in all desirable points. While it is right that every student should do his share of practice for the very poor, I do not believe it is right to confine him exclusively to that practice.

I tell my students that we depend on them for the clinic in the school; and whether it is good or bad will depend on the efforts of the student body. That they must at once begin the work of practice-building when they enter the infirmary clinic; studying the proper and professional means for the work and applying them for the gaining of patients for their individual school work. I often tell them that the young man who cannot do this while in school had better quit and go to ploughing corn or splitting rails, for however well he may learn the science of dentistry and the technical processes required, he will never be able to command a practice.

This demands of students that they give some time to social intercourse among the people with whom they live, and this demand is a good one. It is opposed to the idea of gathering in large bodies in boarding-houses and club-rooms and associating with students to the exclusion of the outside world; and this is good for the student. It demands the exercise of the social virtues with all of its resulting benefits. It is not necessarily opposed to student societies, student gatherings and associations, or to reasonable clubbing together for living purposes.

This teaching gives a school clinic of the best quality by the best means; it improves and elevates the tone of the class and lends interest to the whole of the school work.

DISCUSSION.

Dr. FANEUIL D. WEISSE. Dr. Black's paper only came into my hands to-day. I looked it over, as we have listened to its reading, with a great deal of interest. The careful and characteristic manner in which the subject has been developed has left very little to be said. It remains only for others to present special methods which have been the outcome of their individual experiences.

From my inquiries of the deans of our several institutions and from my personal inspection of dental institutions, the reception department of the New York College of Dentistry is somewhat unique in the examining, classifying, and distributing of patients to the several departments,—operating, prosthetic, and extracting,—and especially so in the receiving of money for work to be done, thereby dispensing with the question of money arising between patients and students or demonstrators.

The reception department is presided over by the examiner of patients and the secretary of the infirmary. It is located on the ground floor. The patient on entering applies to the secretary, who gives him or her an examination slip, for which a payment is made to the secretary of twenty-five cents, which is taken to the examiner. The examiner receiving the same records the patient, numerically, and the name and address in a special blotter for the purpose. Examination of the case follows, and the work to be done and its cost is also recorded in the blotter. The examiner fills out a slip designating the work to be done in the operative, prosthetic, or extracting department, as the case may be, with the price for the same. The patient then returns to the secretary, giving him the slip given to him by the examiner, the secretary makes a copy of the examiner's slip on a department card, he retaining the slip to be filed. The patient pays the secretary the amount called for by the examiner's estimate, the secretary stamps the card "paid" and gives it to the patient, and here closes the financial relation of the patient with the infirmary. The patient then leaves the reception department to take the elevator for the department where the work is to be done.

Our method of obtaining the record of students' work for patients and the registering of the same is also somewhat unique. We use check-books,—like a bank check-book with checks and stubs,—for each department of the infirmary, of red paper for first year men, white for second, and blue for third. At the completion of a given operation by a student the superintendent of the department inspects the same, fills in a check with the date, the operation, and the name of the student, signs the same, tears off the check and gives it to the student as his voucher for the work done; the superintendent then fills in the stub in duplicate of the check issued, adding to it the percentage merit of the work done. At stated times the superintendent tears out the stubs of checks that have been issued, turning them over to the clerk of the infirmary, who enters the work done to the credit of each student in the register of infirmary work. The infirmary register is devised so as to afford space for the continuous record of the work done by each student in the several departments—operating, prosthetic, and extracting—during the entire period of the three years of his college attendance, thus affording ready reference to a given student's entire infirmary work.

A very important outcome of our infirmary experience is the safeguards we have resorted to to protect the institution from trumped-up suits for malpractice. During our career of thirty-five years we have been called upon to defend two suits; the first, in the seventies, was decided against the college; in the second, in 1895, the judge did not allow the case to go to the jury after having heard the case for the plaintiff, on the ground that the plaintiff knew beforehand that the work was to be done by students, that she voluntarily accepted those conditions, and if she was not properly treated she must accept the consequences. Under the advice of our counsel we have hanging on the walls of every infirmary room and printed on all slips and cards that pass into the hands of patients, the notice in reference to the work done for patients, "All work is done by students." With the above decision of the court as a precedent, and the thorough manner in which we inform patients that "All work is done by students" we have felt very secure as to suits being brought against the institution for malpractice.

Dr. Black said that "without the infirmary receipts the college couldn't live." I wish we could say that, because our infirmary has always been an expense.

Dr. G. V. Black. I did not say that without the infirmary receipts the college couldn't live. I said the receipts are necessary.

Dr. Weisse. As to the manner of obtaining patients for the infirmary practice of students, we have never asked students to canvass for patients. Occasionally, only, students ask to be allowed to bring their own patients. I confess I was much surprised at the stress that the writer of the paper laid upon students canvassing for patients and the importance of their doing so for their future professional benefit. I do not know how it would succeed in New York. We have never found it necessary to resort to this way of obtaining patients.

Dr. W. E. Grant. I feel my inability to add anything to this subject further than what has been given here, for two reasons. First, I did not have the pleasure of seeing the paper until the meeting was called to order, and second, because many of the points that I have at my disposal, and which we have been using in our college work, have been obtained from the two gentlemen who have just spoken. I have a number of slips here which I fear the lateness of the hour will prevent me from taking up in detail. I would be very glad to have the gentlemen look them over, however. I can only in a general way add my approval to what has been given. My impression is that there is nothing so important to the dental school at the present time as the subject that is now before us. It is important for several reasons. Dr. Black has touched upon one of the important phases, and that is the financial side of the question. He has said to us that it is important to look after this, not from a standpoint of revenue alone, but that it is necessary that the infirmary should bring in a certain amount of revenue in order to keep a well-regulated institution going. It is important from another standpoint; that is, we are dealing with the men who are about to be our finished subjects, and here is where we are to give them the finishing touches. Discrimination has been made upon this floor between the practical and what we call the theoretical. We are giving them the practical side of things in the infirmary work, and that which they expect to put into active practice at an early date, and therefore, from that standpoint, this subject is a very important one. And you can appreciate its importance by carefully watching the class of work turned out from your infirmary and by watching the rapid improvement that those men whom we incline to term the theoretical students make, by careful attention to the practical side of the infirmary work. The importance of having frequent demonstrators' meetings and of the infirmary being conducted along the lines laid out by the professor of operative dentistry was touched upon in the paper today. I want to say that we took up these meetings in our college, some two or three years ago (a point gained from Dr. Black), and it has been very fruitful and very beneficial to the college work. Our faculty meetings are held, outside of the demonstrators' meetings, once a month. I like the idea of general examination, or examination of all patients by a demonstrator appointed for the purpose. A great number of infirmaries, I am aware, are not doing this. They allow the patient to go directly into the infirmary and the student is his own examiner. I think it is very important that all the patients should pass through one examiner's hands, even though the patient be a call patient. Someone has put the question, Where is the necessity for a patient who is a call patient to go through the examiner's hands? The case does not have to be assigned, but it is just as important that that patient should pass through the examiner's hands as any other, because other considerations of interest to the patient, the student, and the college must be looked after.

Now, the gold question is one which has puzzled us quite a bit, the question as to the amount of money which should be collected for the material used. We have not been able to use Dr. Weisse's suggestion, neither have we been able to use the idea of Dr. Black. We go on the principle that all of our patients are honest, and allow them to pay for the operation when it is completed. Of course, our method of determining the amount of material used, and all that sort of thing, is very similar to what has already been given.

The question of slips, the number of slips to be used and how to classify them, is another important consideration. On this account we have our prosthetic department divided and we have the different colored cards signifying the different departments, and we have found it necessary to use the four slips in each department; four slips in the operative department, four in the plate department, and four in the crown- and bridge-department, using the white slip for the operative, the orange for the plate work, and the blue for the crown- and bridge-work. The examiner also uses the examiner's slip relative to the department in which the patient belongs. Another question that has come up to us is how long to keep these slips. In a measure Dr. Weisse has answered that question; at least he has given their practice. We usually keep our slips longer than has been indicated by Dr. Weisse, but without a definite fixed period. Of course they accumulate very rapidly, and if they are kept for a term of years it requires a great deal of space in order to store them away. We find that the demonstrators are sometimes careless, and it is well to provide a means of keeping a check upon the demonstrators as well as upon the students, and Dr. Weisse has suggested an idea that I think can be used very nicely in the plate-work department and crown- and bridge-work; I even like the idea in technic courses. It certainly offers a suggestion to me that I had not had up to this time. We use the point system, and also the grade, as outlined by Dr. Black. We tell the student the number of points we give him, but we do not tell him his grade, *i.e.* he does not get the grade at the time. There are two or three reasons for that. One is that we have found it necessary for several years to require more work of students than our minimum, and the demonstrators at times have had difficulty in getting the students to do more work, so we do not tell him his grade on that account, and we simply tell him he must raise his grade. Of course you will have a number of students who want to do all the work you can possibly give them, but in some respects we have been fortunate enough to have more clinic than we were able to take care of, and therefore we want to urge the students to do more than the requirements. We like the point system very much indeed, especially in the operative department. In the prosthetic department we have not been able to use it as well and with as much success as Dr. Black indicates. I hope that we can use it to better advantage from this on. Instead of making it on a basis of 100, we make it on a basis of 10. At the end of the year the total is made and, of course, multiplied by 10. We do that simply for convenience. A man that would make a grade of ninety would get a grade of nine. I was a little bit uncertain, when Dr. Black first gave his method of recording the required operation, and also recording the operation when completed, as to whether or not the student body would understand it, but he afterward explained that satisfactorily. We haven't adopted that method, but have used the old method of charts.

I wanted to ask the question as to how patients are assigned. I wish a little later Dr. Black would answer that; whether alphabetically, or in the order of matriculation, or how?

Another point was the amount of time given to the infirmary work. This has been a question of some consideration to us, and we have adopted for the last two or three years the method of dividing our time so as to get in the didactic work by 12 o'clock, and then beginning immediately after and giving up the time from 12 to 6 to the practical work, and of course the first-year students at that time are at work in the laboratory. All of the lectures are given in the forenoon.

Dr. W. H. Whitslar. To conduct an operatory requires science and productive art. It is an art of contemplating methods of application of knowledge, and this becomes almost a science of itself. The conductor must be an artisan to cause the technicals of dentistry to be applied to natural teeth in the mouth. It requires technical skill to do this. We often find students trying to accomplish more than they are able, and here discrimination by teachers is desirable. Often incapable teachers are found who have not the sense of propriety, both as to teaching and as to acquiring the sympathetic co-operation of students. Some teachers are too frigid, repellent in all things, hence fail to be good teachers, no matter how great their knowledge. I believe that in most schools we are derelict in our duty in providing competent instructors, men who have the ability, and who have still more, great experience. Oftentimes we select men of no experience to fill these positions; therein I think we err.

Two years ago I presented a paper upon this subject, and also the year before that,—hence I think that Dr. Weisse is mistaken when he makes the statement that nothing has been presented on this subject heretofore, and I just simply wish to call your attention to one phase of the article read two years ago upon the preparation of students for the operatory. I divided it into eight divisions, as follows:

(1) Appreciation of the value of teeth and operations thereon.

(2) The operator: His health, and care of his clothing and hands.

(3) Deportment, and reception of patients.

(4) Dental chairs: Their mechanism; how to adjust chair to the patient and operator.

(5) Instruments of common use: Engines, clamps, forceps, etc., and their care and mechanism, as well as the care of the operating instruments.

Now, all of the foregoing things have been spoken of heretofore in the didactic lectures, but previous to entering into the operatory these things should be called to the mind of the student.

(6) Examination records. These examinations, I think, should come under the head of a thorough, competent examination, and I would also further suggest that the senior class be divided into sections of two or three students who attend to this examination on alternate days, and that these students be required to make examinations of the mouth and have a chart prepared for them to record what they may observe. They may go into all the various phases of diagnosis of the mouth. I would be glad to refer you to a diagnosis chart that we used two years ago.

(7) Preparation of material for filling teeth.

(8) Classes of operations.

A course of lectures upon this line of work should be compulsory to students.

Upon the discussion of the paper at hand to-night, I have only to thank Dr. Black for the instruction which he has given to us, and we all bow to him as the Socrates of the dental profession to whom we look for great wisdom. However, a man was never so great but that he must have some criticism, and I have one or two little criticisms. I wish to criticize the diagram upon the operative record just exhibited. He stated that sometimes schools are subjected to legal controversies; and this diagram which he has would not support him at all in any legal combat, because the judge and lawyers would be unable to comprehend it. I think the only proper way to do is to have a diagram which shows to any person of ordinary mind the forms of the teeth and where these operations are noted.

The point system is all right; it is a good thing, but it does not go far enough. In small schools, like ours, I think the only way to handle students is not to set a minimum limit upon what they do. When you do that they will reach that limit, and the majority will not pass beyond it. If you say to students, You have to work from the time you enter here until commencement day, then the students have just that one rule to go by, therefore they will do better work. I know that is so, because since we adopted a minimum limit the students do less work than formerly.

Now, as I said before, I have no further discussion upon this paper, but simply to bow to our good Professor Black and thank him for these records which I think have been brought down to a system. A few years ago I tried to evolve a system, and corresponded with all the schools in the country. I received from them their record slips and made charts, which were exhibited at that time, and our chairman of the Executive Committee asked me to bring these charts here for your perusal if you desire to do so at any time. There are a great many good points that may be received from them.

Dr. L. P. Bethel. We have adopted a system of records this year in our school, not perhaps as elaborate as the system that Dr. Black presents, but one we have found entirely satisfactory. There are two forms of slips here, one for "new patients" and the other for the "daily record." You will notice in the right-hand corner of one of the slips, *new patients;* in the corner of the other, *daily record.* Those words are there simply to guide the students. When the patient presents, the student takes a *new patient slip*, and you will notice there is an appointment card attached to it; that, of course, is filled out and given to the patient. Now the student examines the patient's mouth and marks the operation to be performed on the *student's memorandum blank*, and then the examiner examines that mouth and places the operations he finds on the *clerk's memorandum blank*, and the two have to correspond before they are approved, so if the student has missed any of the cavities the examiner finds them and calls his attention to it. In this way you train the student to be thorough. He notes on these slips any other operations that may need to be performed by simply drawing out a line and indicating the operation by symbols which are printed on the daily record slip. The student retains the student's memorandum, and the clerk's memorandum slip is handed to the clerk for filing. As fast as an operation is performed the student simply draws out a line on his student's memorandum slip and indicates it by a symbol and inserts the date; when that patient returns, the student, by looking at his slip sees immediately what operations are still to be performed.

On the daily record slip you will notice the words: Instruction —Preparation—Filling. The student first receives instruction and then that is punched. The preparation of the cavity is examined by a demonstrator and passed upon, and then a demonstrator makes out the order slip, which is a little different from Dr. Black's [illustrating on board]. Where the student receives the gold or other filling material he initials for it, thus making a receipt for the clerk. When the operation is completed the amount of material used is marked on the daily record slip, and of course the total should correspond with the amount of material which has been received from the clerk. If there is a difference, the student is called to account for it.

In the credits for preparation of cavities we have "fair," "good," and "excellent" grades. We also grade the final filling by points. The charge for the work done is entered by the demonstrator on a daily operating slip, the date affixed, and all is approved by this demonstrator; the patient then takes the slip to the clerk and pays for the work.

From this daily operating slip the clerk posts to the clerk's memorandum slip the student's and the patient's names, both being given on the daily record slip. The *clerk's memorandum* is filed under the name of the patient; the *daily record slip* under the name of the student. At the end of each month, or every six weeks, the student's record slips are assorted, and are clipped at the corner so that they are all held together, and the summary of work done noted on the back,—so you have a complete record of what the student has done for that length of time. In the cash book each day is entered the student's name and the kind of operations performed, which gives us a daily record of each student's work. The slips are filed under the card system, filing the slips instead of cards. At the end of the year the slips will all be taken and filed away in a letter file for future reference. Where we are working for students or giving special rates to some person, we mark across the slip "*special.*" In the prosthetic department we have a similar diagram adapted to its needs.

Another method adopted may not be out of place here: If the student is going to make a bridge or anything of that kind, where it requires considerable gold plate, solder, etc., we weigh this, together with the teeth and gold solder, etc., and when the bridge is completed, but before receiving the final finish, we reweigh it. In this way we can get approximately the amount of gold used, and we find that the clippings of gold come back in more numerous quantities than they did before.

In this way we keep a very complete record of all the work that the student does.

This system of record-keeping being so simple, there will be no further explanation needed; by looking over the slips you can very readily comprehend it.

Dr. W. C. Barrett. The work which Dr. Black has planned out is, it seems to me, that which is more appropriate for the advanced bacteriologist. It is not elementary work for dental students, for beginners, for those who know nothing of the mysteries of bacteriological science. The reason why certain well-known organisms are employed for study is because they better and more perfectly and more easily illustrate proliferation, or the formation of the products of bacteria, than do most of those taken from the mouth. How would it benefit a tiro in bacteriology to commence the investigation of unknown bacteria? He must know, he must study, those which are known and which more easily and more clearly demonstrate the principle which it is desired to teach. He is incompetent to carry on the original investigation which demands the knowledge of the expert. It is with that view that Dr. Miller has written; he knew that he was writing for dental students,—for novices. He did not write for the experienced investigator, hence he used simple language, employing as few technical terms as possible; I mean unnecessary terms. We must use the correct nomenclature, but I cannot but conceive that the course which Dr. Black would mark out would befog the student rather than clear his perception to a complete understanding of the basal principles. Let him use such an organism as will best determine and most clearly indicate to him the processes which it is desired for him to study. This is the only criticism which I can make upon that which Dr. Black has so well said. I simply believe that he is recommending to the tiro that which must be the work for the advanced student in bacteriology.

Dr. E. T. STARR. I hope that when Dr. Black gets up to close the discussion he will tell us in what way he makes the marks for the temporary teeth on that diagram.

I think the idea about the point system is a very good one, and likewise the method of not telling the student what his grade is. I think it has been our custom in the past to give the student a voucher for every operation performed, if the operation has been passed with credit. We have had some difficulty in getting students to perform a sufficient number of operations. When they have completed the minimum requirement they want to stop, and on that account we sometimes have many more patients than we can take care of. I think that this method might possibly do away with that difficulty to a great extent.

Dr. H. C. KENYON. In regard to these blanks. In our school each demonstrator has a punch, each different from the others. Whenever he punches a card for material it is permanently recorded who did it, and where there is a place for a demonstrator to sign his name he simply puts a punch-mark there.

Dr. L. P. BETHEL. That is the system we use.

Dr. V. E. Barnes. The question has been brought up that the punch might be duplicated. I hit upon a little scheme which I think will prevent that, and that is, instead of adopting a system of numbers, of making a couple of punches on the card which indicates the grade, the student knowing nothing whatever as to what the grade is.

Dr. A. O. Hunt. I simply wanted to ask Dr. Black to state what system or principle he followed in grading,—not in points but in grading; whether it is a question of guesswork with the demonstrator as to whether a student should have 4, 5, 6, or 10, or whether there is some system about the grading.

Dr. G. W. Dittmar. I am thoroughly acquainted with the point system devised by Dr. Black. We have not followed it entirely, but to quite an extent. There is one thing, however, regarding the point system and credits. For instance, a mesio-occlusal cavity runs from 5 to 8 points. If it is well done, we would probably give the student 8 points and probably give him also a grade of from 85 to 95. If it is poorly done, is it right to cut that down to 5 points and also cut the grade down to 75? If we are going to have a point system we ought to give either the maximum in points and then the grade, or a minimum number of points, and grade as to the quality of the work.

I wish to commend the most excellent paper, and in particular the point system.

Dr. Hart J. Goslee. I only want to take occasion to say that the credit system has been adopted by most all of the departments in the Chicago College of Dental Surgery. While it is not necessary for me to go into the details of it, as the ground has been so thoroughly covered, and because I am scarcely familiar enough with it to give it to you in particular, I want to say that the system embracing a certain *minimum* number of requirements may be made successful for the reason that every student is given to understand that he must satisfy each department as well, and that there is no *maximum* number. Each student thus knows that he must have certain compulsory credits and as many more as the professor demands of him; and if he knows that he must satisfy the head of the department, he is going to do it. The methods that we use are along similar lines to those advocated and presented by Dr. Black.

Dr. J. Q. Byram. I hear some saying that you keep the number of points from the students, and I can see no good reason for doing this. I believe in allowing the student to know just how many points he is getting on each piece of work. And as the doctor said a moment ago, it is not right to grade them differently. If we are to have a point system, each student should be given the same number of points for similar operations. We know that students vary in their manipulative ability, but if a student who cannot do a piece of work as good as Jones, does his best, there is no reason why he should not have the same number of points, if he has put forth his best effort.

The way we overcome students refusing work toward spring is like this: We have our point system divided into gold fillings and plastic fillings (including canal fillings), crown- and bridge-work and plate work, and treatments. Each morning our record is posted so that a student may see just how many points he has. At the end of the year we add these together and strike an average. The average is 90 per cent. Each student is required to make 75 per cent. of the average. If a student is low he must work, and as he works he brings up the average, so that the high men who are always anxious to make 100 per cent. must keep on working in order to keep their grade above the average. As the low men are compelled to bring their grade up to 75 per cent. the high men are anxious to keep on working in order to keep their grade up.

Dr. G. V. Black (closing the discussion). I am very glad of the discussion that has occurred on this subject. I consider it a very important one. I should like very much for the discussion to have fallen more on the general principles underlying this work than upon the particular form of slip used, for I consider that if we understand and appreciate the general principles and the needs underlying them, we will be able to form slips that will cover it. I may forget some of the questions asked and I will request those asking questions to repeat them. One question was in regard to our plan of assigning patients to students. In our school there is so large a proportion of the students who obtain and maintain an infirmary practice of their own that it would not be at all right to assign patients in the order of matriculation, or any other regular order. Therefore, as frequently as may be necessary, a transcript of the record of points made by the students is given to the examiner, and he assigns patients to those students who may need patients.

There is some disposition to mix up the point system of credits with the grades. The point system of credits has to do only with the student's opportunities for experience. The grading of the excellence of his effort is entirely a different thing, and is graded on the scale of 100. We do not give our students the grades; we always give them the points. And we have made it a rule not to give our senior students their grades in examinations, holding that the students who graduate go out upon an exact equality; they carry out with them no difference in grade whatever. If we find a student's grade is not coming up to the point that will pass him, we will begin punching up that student and he will soon find out that his grade is not high enough. But the examination grade or the grade he has made in the operating room is not given to the senior student at all.

Regarding the system of grades. If a demonstrator is grading a filling, for instance, it is his estimate of what the effort of the student is worth as to excellence. I don't think that we can get anything else out of the grading of a piece of plate work. It is the estimate of the demonstrator, or the person who is grading it, as to what that effort is worth as to excellence. If it is a perfect piece in every respect, it is worth 100; if it is imperfect in some little detail, maybe it is worth 98 or 95. And this is the principle upon which this kind of grading is done. The point system, of course, is not grading at all; it is simply a record of the student's experience, his opportunity.

The question was asked in regard to when I would give 5 or 8 points in a mesio-occlusal filling. That would be determined by the size and difficulty of the operation.

Dr. N. S. Hoff. I would like to ask you if in assigning patients in the infirmary you take into account the student's ability and the relative difficulty of the operation to be performed.

Dr. Black. We do. We manage it through the examiner's knowledge of the student.

Dr. Hoff. Doesn't that conflict with your plan of allowing students to bring patients?

Dr. Black. Sometimes a difficult problem comes up in that relation. Occasionally students bring patients whose operations are of such a nature that we must give the student assistance. We have to do that in quite a number of cases. We do not often rob a student of a patient, but sometimes we even do that because of the difficulty of the operation, it being far beyond the student's ability.

Dr. HILLYER. Are all your credits given by one?

Dr. BLACK. Our credits are scattered through the whole demonstrating force.

Dr. HILLYER. How do they compare one with another?

Dr. BLACK. Very well, because practically in the first part of the session they are in continual consultation in regard to it.

Dr. SMITH. Dr. Weisse said that they made no effort to have students bring patients, and yet I assume that they have no lack of patients. With a similar plan in Chicago would you lack patients?

Dr. BLACK. I suspect that we might. I have not tried it lately. I know it was the case years ago. There is one thing about this that I will speak of in a moment, if you will allow me, just to bring it again prominently before your minds. It is a lamentable fact that we have almost no opportunity in our dental school work to give our students a knowledge of dentistry as a business. They have a right to learn everything during their student life that is possible of dentistry as a business, as well as of dentistry as the healing art or science. One thing that controls us very largely in the matter of the collection of fees and the manner of maintaining a clinic is our view of this business side. It is true that our students know very little, most of them, as to what they should charge for this or that operation. They go out into the world blind, as it were. I wish somebody would devise a scheme by which we could give our students a knowledge of the practice of dentistry as a business, because this is an important feature of practice, after all. We may talk about professional ethics and all that to our heart's content, but a student depends upon this practice as a business, and he must do so. I wish we could give them more of it. There would be fewer of them running off into unprofessional methods if they could go from our schools with a good knowledge of dentistry as a business.

METALLURGY: HOW TO TEACH IT.

By JOSEPH D. HODGEN, D.D.S., San Francisco.

Prefatory apologies are in bad taste as a rule, but the title of my paper smacks so much of presumption on my part that I cannot refrain from saying that I was programed and my paper entitled by my friends; and, being "in the hands of my friends," as they say in politics, they, and not I, are responsible.

Teaching metallurgy does not differ largely from teaching other subjects in the dental curriculum. Therefore, like other subjects, the time has passed when teachers agree that this subject can be taught in dental schools by long, tedious, and tiresome lectures, without text-book and without laboratory work. The time is also passed, or should be, when this subject is thought sufficiently taught by any other than one of our own profession. I do not mean to disparage the didactic efforts of those teachers who are without the circle of our calling, but I do wish to emphasize this fact, that it is not metallurgy we desire to teach, but dental metallurgy,—metallurgy applied to dentistry. And it is obvious that no one but a practicing dentist can properly apply this, or any other science or subject in the present dental curriculum.

I have long since recognized that the average dental student takes hold of no subject in the curriculum with the same reluctance he does with the subject of metallurgy and its parent subject, chemistry. It is, then, the first duty of the teacher to dispel this reluctance on the part of the student for the subject. The curricula of our schools are constantly criticized by the layman, the student, and even the physician often, as attempting too much (not to use harsher expressions), in the apparent attempt to teach more science and deeper science than in the judgment of our critics is absolutely essential for the practice of dentistry. I do not mean that such criticism is warranted, but I do venture to say that in the mind of the thinking student, or the thinking layman, or the thinking physician, the prescribed course of study in dentistry, like that of any other, cannot be too thoroughly, too scientifically, and too broadly taught. Nevertheless, the average student is constantly questioning, "Why so much metallurgy, why so much chemistry, to practice dentistry?" and this, unsatisfactorily answered in methods of teaching, accounts for much of the reluctance.

To discuss this "why,"—to discuss broad and liberal education. to discuss the education of students in the sciences which go to make up the science of dentistry, that they may be able to deduce therefrom the principles of practice,—would be presumption at this gathering of teachers. These things are apparent to all.

Too many students are permitted to enter our colleges with the mistake that they are to be taught as parrots; that they are to be drilled from the awkward squad into the scientific soldier of practice. And why not? Are not legions of our fellow practitioners practicing in imitation of one another, without asking why?

Since, from their narrow point of view, students see so little chemistry in the practice of dentistry, the relationship appears so obscure, and so little dentistry is taught with chemistry and metallurgy, is it any wonder that they take to the subject most reluctantly?

I therefore repeat: it is the first duty of the teacher to dispel this reluctance. This may be done by making the subject an interesting one, by demonstrating its close relationship to dentistry, and by pointing out how invaluable the knowledge of chemistry and metallurgy is, in the scientific practice of our calling. Then the question arises, How can we best make it interesting and show its value? It is no easy task to interest a class in chemistry or metallurgy, but I have found that it may at least be partially accomplished by going deeper into the subject, and making it admired for its own sake, by making it as practical as possible and filled with everyday wants. No one is more inclined to teach theory and truths for truth's sake than I, but cold theory, naked facts, and incomprehensive laws are not attractive to most students. No doubt much theory is essential, but it must be so skillfully clothed with practical application that it is not only presentable, but positively attractive.

I can best make my ideas clear, perhaps, by detailing my own method of instruction: First, I am an ardent advocate of a good text and recitation; second, I would relegate all so-called "lectures" to old methods, doing no more in that line than elaborating where the text, to avoid voluminousness, is insufficient, and explaining where the text is lacking in perspicuity; third, I depend upon the laboratory for two-thirds of the instruction.

Following this idea, the student is assigned a chapter in the text, which he prepares for recitation and laboratory advantage. The subject studied in the assigned chapter is first wrought out in every possible detail by the student, with the aid of his text and laboratory manual, in the laboratory. A recitation is then held at which the teacher observes where to explain and elaborate. In this method the student has three opportunities of learning the subject, and it can be presented theoretically, practically, and applied from every point of view.

The text I employ devotes its first five chapters, of nearly one hundred pages, in a more or less introductory way, to "the properties of metals," which is a physical view of them; "the combination of metals with non-metallic elements," which is a chemical point of view; and "melting metals," and "alloys," which are strictly metallurgical. These chapters may be gone over more or less rapidly, as the teacher desires.

The Laboratories. Four rooms are allotted to the laboratory instruction of chemistry and metallurgy, plans and photographs of which accompany this paper as part of the exhibit. These rooms comprise what we generally call the chemical laboratory, which is used also for the wet and small metallurgical work; a preparation room, for the use of instructors; the metallurgical laboratory, which may be entered from the chemical laboratory as well as from the hall, where the furnaces, forge, cupel furnace, lockers for unfinished work, rolling-mill, anvils, cases for apparatus, supplies, etc., are to be found. Off of this is a professor's room, which is the executive part of the laboratories, and a repository for books and easily injured apparatus. All rooms connect with a large hall.

We call the time spent in the laboratories weekly, "laboratory periods." These are on Mondays from 1 to 4 o'clock, and the recitation is from 4 to 5. The periods occur, therefore, just before the recitations. The first period is entitled "assignment of lockers." The student pays a breakage fee of five dollars, receives a numbered receipt, and has his choice of locker in accordance, though there is really little or no choice. Thirty-two articles of apparatus, etc., contained in each locker, are then invoiced to him, to see that they are in perfect order, after which he is absolutely responsible for the same, and must *at all times* have at hand each article. If he breaks or ruins one, the instructor gives him a requisition on the office, where the student is charged with or pays the price of the new article, and returns with an order on the laboratory supplies for what is wanted. No smallest article or reagent can be removed from the laboratory without a requisition from dean, professor, or instructor of chemistry and metallurgy; so we are enabled to "keep stock." A list of these "senior requirements," or locker contents, together with a copy of the first and all periods, and a requisition blank, are exhibited.

Six long benches accommodating nine students at a time, and provided with three sets of lockers, one set each for freshman, junior, and senior classes. Each student is supplied with separate gas-cock, and water in reach. A set of thirty-six reagents and twenty-five salts, metals, etc., supplies one-half the bench, a duplicate lot supplying the other half. A list of these reagents accompanies the exhibit.

Laboratory manual. We have a manual in prospect as soon as our experience is sufficiently ripened, but at present we are using "advance sheets," as it were, done on the mimeograph and handed to each student. These, under the name of "senior laboratory procedure," numbered periods, accompany the exhibit.

Note-book. Nothing is more essential in laboratory work than a proper note-book. The study of chemistry and metallurgy demands a thinking application. The note-book serves a manifold purpose. Prominently, its advantages are—(1) The student is able to carry from the laboratory more, and more accurate, knowledge than is possible by mere memory or temporary comprehension; (2) it stimulates a real thinking process of how and why, so important in the study of a science; (3) it supplies an opportunity for expression of thought, review, study, and correction of errors; (4) it enables the instructor to determine what experiments are best suited for teaching certain theories and truths; to comprehend the individual work of each member of the class; to take the roll, etc.

Our note-book (a new and a used copy is presented with the exhibit) is sold to the student at the small cost of ten cents a copy. The notes are made in manifold by the use of a carbon sheet; the original is torn off at the perforation and dropped into the desk, as into a letter-box, for the instructor, as the student passes from the laboratory. The carbon copy is retained in the note-book for the use of the student. The instructor looks over the notes, corrects errors, takes the attendance therefrom, and learns the best method of teaching and the progress of the students. The cover of the note-book gives all the necessary laboratory rules and suggestions, and a list of abbreviations.

The course of instruction. To more than outline this would be tedious to those not interested in the instruction of this subject. I will therefore content myself with again referring those interested to several copies of the text, copies of the "senior laboratory procedure," or "periods," the note-book, etc., which are among the exhibits, trusting they will avail themselves of the opportunity of looking them over, and offer in discussion whatever suggestions may occur to them in the perusal of the same.

I would, however, explain that the course comprises twenty-eight weeks, of three hours laboratory instruction and one hour recitation, per week. Further, that the first individual metal considered is *"Lead,"* Chapter VI, and with it the sixth laboratory period. This is discussed first for the reason that its metallurgy is simplest. The student is here taught the simplest character of reduction, tests, etc., the preparation of the simplest alloys (lead and tin), and the casting of the easiest ingots. Hence this metal seems a logical beginning of the study of metals. *"Antimony"* follows,—without a laboratory period, from the fact that it is little used outside of alloying, and this is practically considered under other alloys. Two recitations and two laboratory periods are given on *"Tin,"* on account of its prominence, the practical work it affords, and the ease with which it is handled.

In *"Copper,"* most difficult alloys of brass are made. Some of these are swaged into metallic bases for specimen work in prosthetic dentistry. An electro-deposited base of copper is also made, the student making the cell or battery in a glass tumbler with copper and zinc as elements and copper sulfate solution as the excitant, preparing the cast and using a crystallization dish containing copper sulfate solution as a bath. The base may afterward be tinned and vulcanized upon for specimen work.

Under *"Zinc,"* the basic zinc cements are prepared from the metal, shaded with slate, etc.; this forms a good practical lesson.

In *"Silver,"* two laboratory periods and two recitations are held. Refining the metal, preparation of pure silver nitrate, alloys for various purposes, and solders are made, obviously more for their technical than practical value.

In the consideration of *"Gold,"* five laboratory periods and four recitations are held. The student is required to bring to the laboratory gold scraps, filings, old jewelry, or any alloys containing at least two and a half pennyweights of pure gold. This is first melted in a button and tried on the anvil for its malleability. If malleable, some bismuth, lead, antimony, or what not is added by the instructor, record being kept of the addition by him and by the student, and the whole is then roasted until malleable again,—teaching the method of rendering brittle gold malleable. The student is taught that this process does not necessarily raise the karat of the gold employed, or, in other words, is not a refining process.

To refine the button it is alloyed at the next period with three times its weight of silver, and the "quartation" process gone through with. This, as a rule, with a careful student, gives gold of about 997 or 998 fineness. Taken in the form left by quartation refining, it is placed in aqua regia for greater refining. From this we usually obtain from each student a gold of sufficient fineness to roll to No. 30 or beat to No. 4 foil, some of which is exhibited. A portion of this is used practically to fill either a tooth in the mouth at the infirmary or an extracted one (see exhibit). One of the greatest truths taught is that pure gold exhibits the property of welding when cold, and the greater its purity the greater its weldability. The student is too apt to think the various preparations of commercial foil, pellets, etc., are treated in some way to make them weldable. He is confused by the terms "hard," "soft," "cohesive," "non-cohesive," "semi-cohesive," etc. This work teaches two kinds of foil, *pure* and *impure,* respectively weldable and non-weldable. Gold base-plate and solders are made, partially supplying the wants of the infirmary, while at the same time teaching the student.

The last two chapters of the text are devoted to the consideration of *"Amalgams,"* and furnish four recitations and four laboratory periods. Our laboratory work on this subject, I feel, is yet undeveloped, on account of the want of expensive equipment. Each student prepares and studies several different dental amalgam alloys, and analyzes old amalgam plugs. But I am confidently hoping to perfect the course by the use of Dr. G. V. Black's instruments and methods at no late date; then our opportunities will be unsurpassed. For a long time all the dental-amalgam alloys used in the infirmary have been made by the students, or under the direction of the laboratory instructors.

Each student pays a deposit of five dollars on taking his locker in the chemical or metallurgical laboratory. He replaces each article with which he is furnished, at the time it is broken or destroyed, at his own expense, and is returned four dollars at the end of the session, the remaining dollar of the five going to replace the laboratories in proper condition for the next class. In this way, by careful, systematic, and economic management, the laboratories are just about self-sustaining.

I trust you will pardon the length and uninteresting character of the paper, and also my constant reference to the subject of chemistry. I regard metallurgy as but a part of the greater subject, chemistry, and so inseparable that the former cannot be considered without dealing more or less with the teaching of the latter. My time, taste, study, inclination, and devotion has been and is almost exclusively chemical, therefore the study of pure chemistry and dental chemistry has been my hobby, and metallurgy is more or less incidental.

Thanking you again for your patient attention and consideration of my exhibit, I will close.

DISCUSSION.

Dr. J. P. Buckley. It is with a feeling of sadness on the one hand, and regret on the other, that I find myself called upon to *open* this discussion. After I had been called upon by your committee and had decided to attend this meeting, one of the things that I looked forward to as giving me a great deal of pleasure was that I expected to meet here the gentleman who, according to the program, was to immediately precede me in the discussion of this paper. I never had the honor of meeting Dr. C. J. Essig in person, but I feel that I have met him oftentimes in the noble, inspiring, and lasting thoughts that he has left to the profession which he followed. So I regret that his absence through death necessitates my being the first speaker on this occasion.

I open this discussion, on the other hand, with a feeling of regret that Dr. Hodgen,—a man, too, whom I never met,—could send a paper to Nashville and one to Minneapolis, but could not send one to Chicago. So I regret that I haven't had the opportunity of seeing this paper until through the kindness of Dr. Owre it was placed in my hands last night that I might look it over and gain the salient points; but in my effort to remember all of the good things that were said here yesterday, and the fact, too, that every time I would get started on a good point a locomotive of some sort would come up the main street of this city, confused me so much that I found it difficult indeed to confine my mind to even the reading of this enticing paper. But I have listened very attentively, as have each of you, to the reading. Dr. Stubblefield has read the paper with such a distinct voice that I now feel somewhat familiar with its contents.

The thing that impresses me most in connection with this subject is the practical manner in which the essayist has presented it for our consideration. He has certainly shown us that the subjects of metallurgy and chemistry are interesting ones. I have been familiar with the fact for some time that dentists as a rule fail to take an interest in anything which relates to chemistry or metallurgy. Metallurgy being based upon chemistry, they feel that it is impracticable, that it is uninteresting. I am glad to know that the dental teachers, at least, of this country are interested in this subject. I was pleased yesterday in the address of our worthy president where he referred to teaching chemistry in the first three years of the dental course. I was pleased when I noticed that he emphasized the necessity of teaching this science, which underlies the study of metallurgy, in the first three of the coming four-year course, but I was surprised at the statement of a gentleman who followed, who is, I am informed, the dean of a dental institution, who feels that chemistry is so uninteresting and unimportant that a sufficient amount of it could be taught in two years. The man who makes that statement forgets the fact that dentistry is based upon four fundamental sciences, one of which is chemistry. The man who makes that statement, gentlemen, is unfamiliar with the fact that chemistry, the underlying science of metallurgy, is commingled with almost every study taught in our dental institutions. So I regret that I heard that statement made by, as I am told, the dean of a dental school.

The essayist has given us in detail a discussion of the outline, or I suppose I had better say method, which he pursues in teaching metallurgy to dental students, or, as he has chosen to call it, in teaching dental metallurgy. Now, there is one element which logically precedes method in the presentation of any subject to any class. The essayist had this element prominently in mind, although he failed to call our attention especially to it. But that thing upon which method depends for its life and its vitality is the aim of the teacher, the results which the teacher expects to accomplish, or, if you wish to call it so, the teacher's ideal. Tompkins, in his "Philosophy of Teaching," defines method as being the way, the process, the movement by which ideals set up are realized. The teacher forms an ideal; he sees the results to be accomplished; and then the way of accomplishing those results, or the process of impressing his ideal upon the minds of the students, naturally claims his attention. The essayist makes the statement in his paper that it is difficult for the teacher in metallurgy and chemistry to succeed in arousing the interest of the students. That I believe to be the only statement I noticed throughout the entire paper to which I must take exception. Whether or not metallurgy is interesting or uninteresting to the dental student depends, it seems to me, wholly upon the ability of the teacher to present the subject. And the teacher's ability to teach this subject successfully, that it may be interesting to the students, depends upon two special qualifications. The teacher, of course, must have all the requirements that go to make a teacher in general, but besides this, the successful teacher in metallurgy must have these two special qualifications, and the essayist mentions those qualifications, and yet he says that that specially qualified teacher fails to interest a student. The first qualification to which I wish to call your attention is a knowledge of chemistry. Second, equally as important as the first, is a knowledge of the practice of dentistry. Now it is a fact that dentists as a rule are not sufficiently versed in the science of chemistry to enable them to teach it, so the deans of our dental institutions are compelled, whether they wish to or not, to go outside of our profession, to go to the medical profession and to the universities, and there select the man to hold the chair of chemistry in our dental schools. And a glance through the catalogues of these schools shows that with few exceptions the chair of chemistry, not a dentist, teaches metallurgy. Now, gentlemen, with this fact prominently in our minds, we can see why it is that the dental student enters upon the study of chemistry, and especially metallurgy, with the degree of reluctance to which the essayist has referred. I reiterate, then, that whether or not this subject of metallurgy is interesting to the dental student depends solely upon the teacher's ability to present the subject, and this depends upon these two special qualifications.

There can be no division of opinion on that part of the paper where the essayist refers to teaching metallurgy in the laboratory. He says, I believe, that he spends two-thirds of his time in the laboratory. There can be no mistake in this. If we wish to achieve the highest result possible to be achieved in teaching chemistry, we must teach it first in the lecture-room, where the student gleans a faint idea of the facts presented, and then that lecture must be supplemented by a thorough laboratory course where the idea that was faintly gleaned is thoroughly impressed upon the mind of the student. And what is true of chemistry in this regard is equally true of metallurgy. Metallurgy must be taught in the lecture-room and the lecture supplemented by a thorough laboratory course. But as the teacher, in order to successfully teach metallurgy, must have a knowledge of chemistry, so too must the student, before he can arrive at the point where he can comprehend metallurgy as we would like to teach it or as it should be taught, be first grounded in the principles of chemistry. And we find in the institutions where we have but two years of seven months each,—I believe in California they have nine months,—in which to take up and complete both the subjects of chemistry and metallurgy, that by the time we have these students who know nothing, or practically nothing of chemistry,—and I say this with all due regard for the high schools,—that by the time we take them and familiarize them with the science as we must do, and get their minds developed so that they can comprehend and understand metallurgy, our time is very nearly exhausted; so we have been handicapped for time in the teaching of this subject, metallurgy. It would simply be impossible for us to take the class of students that come to us to-day without any university training and first familiarize them with chemistry as we must do, and then follow out this extensive outline given us by the essayist, all of which I concede to be thoroughly interesting and practical if we had the time to teach it. But we are rejoicing over the fact that in the near future another year is to be added to our course, and we hope that the majority of the deans will not underestimate the value of this study and that more time will be assigned to those who are teaching chemistry and metallurgy. And we hope then to be able to go into chemistry and teach it as it must be taught and have sufficient time to carry out as extensive an outline on metallurgy as was given in this essay.

I would like to say something about teaching metallurgy in the laboratory, but I have already taken up so much time that I will do this but briefly and hurriedly. This is the place where I feel especially at home. The one who directs a laboratory must be the individual who has given the lectures, or else someone who is intimately acquainted with those lectures. There must be an harmonious relation between the director, if he be not the one who is giving the lectures, and the lecturer himself, that the faint idea of the facts presented in the lecture-room may be thoroughly impressed in the laboratory. In the lecture-room the lecturer presents the facts to the student, and those facts are brought home to him in the laboratory. And then, too, the successful director or teacher of metallurgy in the laboratory must not be a man who is contented to sit upon an upholstered seat in some prominent part of the room. He must be willing to get right down among the students and see that each and all are taking an active interest in the work, see that they are following out his directions not in a parrot-like way, but that they know why they are doing that which they have been asked to do.

I must, before taking my seat, congratulate the essayist upon the practical manner in which he has presented this subject for our consideration.

Dr. ALFRED OWRE. After a careful perusal of this interesting and instructive paper and exhibit, I find very little to add or criticize. Perhaps a few reiterations, modifications, or suggestions will be of some value.

The first statement: "Teaching metallurgy does not differ largely from teaching other subjects in the dental curriculum." Very true; however, it should always be borne in mind that this subject presents the same difficult problem to solve as do other fundamental sciences which must only be partially drawn upon in order to lay a solid and thorough foundation for a subsequent successful modern dentist. *E.g.*, How much of the general science is it necessary to teach to gain a clear understanding of it, and how much further than that should the work be carried? As a method of teaching the essayist suggests generally short lectures, recitations, and laboratory work. This has gradually been adopted by a majority of colleges and is used in nearly all lines of teaching, as it gives best results and only needs constant reiteration.

Again: This subject should be taught by one of our own profession, especially since it is *metallurgy* applied to dentistry that we wish to teach; and further, he says it is obvious that no one but a practicing dentist can properly apply this, or any other science or subject in the present dental curriculum. In a certain sense this is so, but it is also a Utopia in dental teaching which I think is too far distant in realization, for the following reasons: Professional men, however successful as practitioners, are seldom efficient teachers. Few of them have ever studied how to teach, and still fewer ever acquire this *paramount* accomplishment. The science of teaching forms a part of the curriculum of colleges of science, literature, and arts. Metallurgy is wholly dependent upon the mother science, chemistry. How many dentists are good enough chemists, how many have specialized in chemistry or metallurgy? Furthermore, if we had an overflow of such men, how much time could they devote to the practice of dentistry proper? Now, this is a general synopsis of the situation, and I am happy to note some exceptions. So I should rather compromise when necessary and I observe that a number of schools employ men with only baccalaureate degrees to teach chemistry, or chemistry and metallurgy, and then have the special dental application taught by dentists.

The essayist speaks of the reluctance shown by students in taking hold of this subject, and the necessity for dispelling such reluctance at first. As a cause I think he refers to public criticism on the fullness of our course, etc. Whosoever these public critics may be, they should be ignored generally, for no one can inaugurate a dental curriculum better than men of our own calling. However, they may be allowed to give a just criticism on the curtailing of practical dentistry in some places. Otherwise the essayist has the remedy well in hand, and it is outlined to perfection in the paper. For instance: In order to make this subject an interesting one a partial remedy is suggested by going into it deeply enough to make it admired for its own sake; next, the practical deductions should predominate. Theory is essential, but must be so skillfully clothed with practical application that it is not only presentable, but positively attractive. Right here the essayist has struck the keynote to the whole situation, and from my own experience I heartily indorse such methods. Personally I try to dispel this reluctance at the very first by preceding the regular course with one or two lectures on the history of metals, metallurgy, and metal work, illustrating as far as possible with specimens from various countries, referring to masterpieces of metallic art, such as students are apt to know more or less about.

As to the course itself, the essayist ought to be congratulated for being able in a measure to carry out his ideal. Generally speaking, metallurgy receives enough attention, as it is outlined at present in the University of California. There is some repetition in the laboratory work, and this is only referred to because if left out it would give more time for practical work. Again, some of the work done in the metallurgical laboratory is in other schools called chemical,—another example of the intimate union of the two subjects. The order in which the work is taken up might be modified some; for example, the alloys should not be considered until a few of the most important metals have been dealt with in full. The student, having thus found out the shortcomings of the properties of the individual metals, a reason for alloying becomes apparent. I take up iron first (*e.g.* after preliminaries as outlined by the essayist), because it is typical in its metallurgy; students are somewhat familiar with its properties, such as its industrial and commercial greatness, its uses for dental appliances, instruments, etc., which all tend to make it interesting. Then gold, silver, copper, tin, mercury, alloys, and dental amalgam alloys, finishing with the rest enumerated, and a few more, such as cobalt, nickel, manganese, magnesium, etc.

Dr. J. H. Kennerly. I am not a metallurgist, consequently I do not care particularly to discuss the paper from a metallurgical standpoint, but to set straight the gentleman who opened the discussion on this paper. He refers to the outline of the course in the first, second, and third years as outlined in the address of the president. In my reference to the paper I stated that sufficient chemistry could be taught in two years. The gentleman failed to grasp the point that I wanted to make, and it was simply this: If you will notice, in the discussion of the president's address there was absolutely nothing said about practical work; adding more theoretical work in the first and second years, carrying the fundamental principles on to the third year, and practically leaving only one year for dentistry proper. My idea in putting chemistry in the first and second years was simply that we should teach more of it in the first and second years, and complete it in the latter. If you teach eight hours a week, as we do, instead of three or four, I think you will grant that we can accomplish as much in two years as ordinarily would be accomplished in three. That is the point that I wanted to make, and I repeat that by so doing you would get more than the president of this association demands. He demands an equivalent of the medical chemical education. Eight hours a week for two years will give you more than any medical school in the United States teaches.

Dr. Buckley. I see the point that the gentleman makes, and it is well taken. Of course, as I indicated in my discussion, I understood that he intended to underestimate or minimize the value of chemistry.

Dr. N. S. Hoff. I cannot discuss this paper, but I want to ask a question. In many schools there is no opportunity for doing laboratory work in dental metallurgy, as the facilities required for it in the way of laboratory room and apparatus are not to be had. Would it not be possible, where such conditions obtain, to teach it in a demonstration course, in which all the processes might be carried out before the class without requiring the students to actually do the work? Would not such a course be of some value? I would like to have the opinion of some teacher on this point, if he is willing to give it.

Dr. Alfred Owre. That point is very well taken, and I will outline the course in the University of Minnesota. There the chemistry is in charge of the master of arts who has studied chemistry in Germany. After the students have completed their laboratory work, such as the quantitative and qualitative analysis, then there is a course in alloys given in Dr. Hodgen's metallurgical laboratory. I think they perform something like four or five experiments, and that finishes the chemical work in the laboratory. The quantitative analysis is not carried out very largely by the students, owing to the fact that we have not a sufficient number of balances, instruments, and appliances. We get something like seven or eight every year. These are imported from Germany at great expense, and they wear out very soon, so that we are handicapped there. The lecturer makes a great many of those experiments himself in the course in the lectures.

Then in the dental application: I have charge of that myself and give something like thirty-six lectures and five half-day demonstrations. There I take up the purification of such scraps as the dentist has, silver, gold, and platinum, and I conduct that from beginning to end before the class. It is not obligatory for the students to do any of this work, but I usually call down four or five students and let them assist me. I have a very small demonstration room, and have the class all around me so that they learn, I think, as much as if they did the work themselves. Then I make the alloys in the same manner. After I obtain the pure silver or gold I make the plate material of various karats and various composition, such as is used in the crown and bridge department and the plate department, and I let one of the students take it down and roll it out and deposit it with the clerk to be used. So he has followed the process from beginning to end, from purifying the scraps until he has the alloyed plate, although he has not done much of it himself. Now, if students have some scraps and want to go through this process themselves, I give them the key to my laboratory and let them perform the operation and tell them to call on me for personal demonstration. We have an obligatory requirement, which is the manufacture of dental alloys; that they must perform themselves. I take from six to eight students at a time and demonstrate this from beginning to end, —selection of material, weighing, etc., and tell them the reasons for performing these operations in such and such a manner, and I invite the class at all times to ask me questions. If you haven't tried this method, I think you will find that it is very exhaustive. It is more difficult for a teacher to answer questions than to ask them. After melting this alloy they have to file it and strain it, pass the magnet through, etc., aging according to Dr. Black. The student makes ten ounces and pays for the material, hence it is his own. Very few of our graduates buy dental amalgam alloys after finishing this course.

Dr. W. E. Grant. I just want to emphasize one point brought out in the paper,—the suggestion of Dr. Hodgen as to the use of a tablet and requiring the students to write out the work of the afternoon in the laboratory, tearing off one sheet and depositing that in the laboratory and the student keeping the carbon copy for reference. We have used that for two years. I might say that Dr. Hodgen is a Kentuckian and was reared near Louisville and we have had the pleasure of a visit from him. We have used that method and the professor of chemistry and metallurgy likes it very much. It enables him, as Dr. Hodgen has indicated, to get at the attendance, and it compels the students, in a large measure, to go through the work themselves, and it certainly does not permit of any copying outside of the laboratory. The professor of the laboratory has two assistants with him every afternoon, and of course, being assisted in that manner, they can prevent copying, to a great extent, in the laboratory.

There was a point brought out in the paper that I don't agree with,—that is the fact that the work is strung out for a long time. The essayist recommends twenty-eight weeks, four hours a week, three in the laboratory and one in the classroom. I think it is a great mistake to string out any subject over a long period of time. I believe better results are obtained by devoting a great number of hours in as short a number of weeks as possible. Your students are confused if work is too much divided.

Dr. S. H. Guilford. I think that in the teaching of this subject very much depends upon the individuality of the teacher and his ability. I was very much pleased with the remarks made by Dr. Bethel, particularly when he said that he believed the successful teacher of metallurgy must necessarily be one who understands the practice of dentistry. The reason why we have so few good teachers of chemistry and metallurgy in the dental profession is that busy dentists do not feel able to give the time to it. Medical men are selected to teach chemistry and metallurgy because they devote comparatively few hours a day to their practice, and the rest of the time they can give to college work, whereas a dentist who does anything of that kind sacrifices more than he feels able to. It is deplorable that we have to depend on the medical profession as much as we do. I believe every school would be better for having a practical dentist filling every chair, because a dentist knows better than anyone else what a dentist needs. This brings out a point in reference to Dr. Essig. Dr. Essig was a practitioner of dentistry and had a very full practice, but early in his career he felt the desire for a more thorough knowledge of chemistry. He placed himself in the hands of one of the best professors of chemistry in Philadelphia, fitted up a little laboratory in his own office, and devoted all of his Sundays to it, until he acquired a very thorough knowledge of the science. It was that knowledge which led to his selection as professor in one of the dental colleges. After he left the first institution and entered another, it did not fall to his lot to teach chemistry, but metallurgy, and he was able to teach it all the better on account of his knowledge of chemistry. So that he should have been, and I presume he was, an ideal teacher of metallurgy. I mention these facts because many here do not know them. If we had a greater number of this class of men, these subjects would be made more interesting and they would be properly taught to the students.

Dr. D. R. Stubblefield. I have the authority in my hand to discharge a duty that I find is unnecessary. Dr. Hodgen wrote me to follow up the discussion on his paper and to reply to criticisms made. To this end, I wish to discharge him of one imputation (very slight, to be sure) that Dr. Buckley made. He presumes that Dr. Hodgen sent a copy of his paper to me at Nashville, but that is not so. He sent it on here with his exhibit, and I didn't read its conclusion until I read it before you.

I wish to add my corroboration to the remarks that have been made along the line that has just been pursued by Dr. Guilford. I have had the duty of discussing metallurgy for quite a number of years in our school, and I was obliged to teach chemistry with metallurgy. The point that I have always realized and tried to make very clear was that metallurgy was in no sense not chemistry; that there was no line of demarkation that could be drawn between them. In teaching chemistry because I was a dentist, and because I saw just these practical necessities that have already been presented, I was carefully preparing the way for the time when I could turn and say, Now we have entered a field that has a practical trend, a practical value easily seen. This is chemistry which is known as metallurgy, because a metal or a metallic element is none the less a chemical element because it possesses the peculiar properties of a metal. And in this way I hypnotized them, as it were, and they found themselves discussing metallurgical subjects, of a practical nature, that were more and more strongly presented as we advanced.

One more word, with reference to the necessity of having practical dentists as teachers. I have for years realized and believed that the very best teacher was the man who was a practical dentist, fully prepared and equipped to teach the subject desired. I feel we made a mistake because we could not have every man in our faculty a practical dentist; not that these medical men may not teach in a general way, and even broadly, the subjects desired, but I have a conviction that a practical dentist knows something of the application of those branches to our needs that the man who looks at it from the outside can never know, I don't care how well informed he may be. I believe there is a practical suggestiveness about the knowledge of a man engaged in the practice of dentistry, which enables him to fit the branch more thoroughly to the needs of dental students.

In conclusion, I shall write to Dr. Hodgen and tell him that the criticisms were all favorable, and with some few exceptions I must add my unqualified indorsement. I do not believe that he has dragged it out too long, and I do not believe that we can get too many practical, and therefore desirable, results even by as long a course as he presents.

THE TEACHING OF PROSTHETIC DENTISTRY.

By GEO. H. WILSON, D.D.S., Cleveland, Ohio.

From the make-up of our program it is very evident that the thought uppermost in the minds of the Executive Committee was, "How to Teach." A more central thought or a more inviting subject would have been difficult to find. Should we have many positive though opposite views expressed, and each writer and speaker should assert that his method is the nearest to perfection, he would be excusable, because it is to be hoped that every man who has been teaching from five to fifty years has developed and is pursuing with all his might his highest ideal. It will be deplorable if there should be one of us so self-sufficient that there will not be at least one point so strongly presented to the mind that through it his work will be better for the remainder of the year. The same idea may be presented several times, but that will only demonstrate its utility and confirm the users in its value.

In my own mind I am satisfied that the teaching of prosthesis is the most important subject in the dental college curriculum. There are several reasons for this. I believe that it is universally a study of the first year, and, being the one so-called practical study, it is the most attractive and appeals the strongest to the student's heart. For this reason the teacher of this department has a great responsibility resting upon him. It is within his power to mold the plastic clay of the human minds about him so as to develop broad-minded, liberally educated professional gentlemen, or it is possible for his influence to be toward the other extreme, a mere mechanic, and such as a young man in a dental parlor described when he said, "A man cannot be an honest man and practice dentistry." The ideal teacher of this department will inspire the student with the necessity for the correlated branches of anatomy and chemistry; the importance of these branches being established, the others assume their natural relationship. It is this teacher who has it in his power to first establish by example the meaning of "a professional gentleman"; and this department first demonstrates the necessity of manipulative excellence. Many of the students entering the schools have the minimum preliminary educational requirements, and many of these have spent several years in pursuits that have not tended to keep at par the training with which they are accredited. Therefore it is possible for the unsympathetic, unprepared person, trying to teach this department, to spoil many a diamond in the rough.

The questions naturally arise, What are the methods necessary to make the most of this department, and how are they best used? We make the assertion that all methods have virtues, and the best results are obtained by the best combination of the various methods. The difficult problem to solve is, What is the proper ratio of one method to another?

There is one factor in successful teaching that must not be lost sight of, because it is the essential element of all meritorious work,—that is, the teacher's individuality; but that is entirely outside of the pale of our subject, and can logically only be mentioned, not considered.

We will classify the methods of teaching prosthesis as follows:

- (1) *Didactic*
  - Lecture.
  - Classroom
    - Quiz.
    - Recitation.
- (2) *Technic*
  - Class as a whole.
  - " in sections.
- (3) *Practical.*

Didactic. This general method we place first because we believe that it is the most important of all the methods in producing professional men; the technic and practical methods develop the artisan. Without this essential phase of dentistry our calling would be a failure; with the higher intellectual and moral training it is lifted out of the common, to the more exalted position of a profession,—thanks to the noble character of the leaders and teachers of dentistry forty and fifty years ago!

The didactic system contemplates two distinct methods,—the lecture, in which the teacher does the talking, and the classroom, in which the student does the principal part of the talking.

The lecture we place as the most important of the didactic methods for producing professional men. The lecture-stand is naturally occupied by the older men of the school. "Old men for wisdom, young men for action." The lecture-room demands the most active mental exercise, hence is the better fitted to develop mentality and individuality, the essential features of professionalism. The lecture is the place to teach economically the reason for and the philosophy of the methods taught in technics and practice. It is the place to teach students to receive mental impressions and to make practical use of them. It is very exasperating for a man of mind to hear a man of body say, when a principle has been thoroughly exemplified, that he does not understand it, but if he can see it done once he can do it himself. What mechanic cannot? It is this lack of mental development that keeps many men from dental societies.

I know that there is a great cry going up all over the land for practical methods,—practical, how to do something,—as though the ability to get the dollar and get it quick is all there is in this life. We of a more esthetic and broader mind must not be carried off our feet by this paroxysmal babble; we must think of the honor and glory of the profession we are to hand down to our children and successors.

Classroom Methods. The two subdivisions of this subject contemplate two distinct principles and are used for different purposes. The first, the quiz, is designed to supplement the lecture work, to see that the students have comprehended the matter previously taught, to aid them in grasping the thought and expressing it in their own words. It should aid the student to think for himself, and cultivate a taste for reading upon the subject in hand. The best results should be obtained by the lecturer quizzing upon his own subject. The recitation plan has for its central thought the idea of studying a book and putting into words a thought the student may never have heard expressed. The student must depend largely upon his own judgment what to commit and what to read over. He will be most fortunate if he does not find that he has memorized the non-essentials and ignored the essentials.

It seems to me that the teacher should be a mentor, a friend to advise and point out the way, and not a taskmaster to see that a stunt has been done. This is the idea rationally implied by the two methods, but of course always modified by the teacher's individuality. It always impresses me that the recitation applied to mature minds was an acknowledgment of inability and unfitness upon the part of the teacher. The argument is often made that the recitation gives the student something to do, therefore he is interested. It is obvious that the lecture and classroom work is by word of mouth; someone must talk, and only one at a time If the student can tell the story more concisely and impressively he certainly should tell it, but it is evident that the teacher is not the man for the place. The truth is, only a very few students give a good recitation. At least one-half of the students will waste most of their allotted time, and that means at a very conservative estimate a loss of twenty-five per cent. of the hour assigned. The recitation plan *per se* I am radically opposed to, while I am as strongly in favor of the quiz.

Technic Methods. It needs no argument with this association to confirm the importance of technics, but we are not a unit as to what, how, and how much should be taught in this course. To answer the question, What should be taught in technics? I would say, Every operation and mechanical process should be performed technically. How? is a long subject by itself, and we simply pass it over. How much? we will answer by considering time; that is as much time should be used to cover all kinds of technic work as is used for practical work. The ratio between each technic course and the corresponding practical work would not be the same, but the totals would be.

I have made two subdivisions of technic teaching: "Class as a whole," and "Class in sections." The prevailing system has been to teach the class as a whole, no matter how many it may contain. This has proved a difficult problem, because some are so much more expeditious and successful in whatever they undertake that it works a hardship to keep a pace commensurate with the slowly plodding ones. I believe that the time will come when the large classes will be for certain purposes divided into sections of six, eight, or ten.

Practical Work. Perfection in this department is in one sense the aim sought by the other methods, and can justly be considered the last step in making the finished operator. We do not desire to graduate a man with educated, refined instincts, and poor manipulative ability; nor do we wish to place the seal of commendation upon the man who is a finished mechanician and is intellectually and morally below par. Of the two I believe that the patient had better intrust himself to the care of the gentleman.

Thus far all we have said is general, and is as applicable to one department as another. In my practical application of these ideas I divide the subject into plate-work and crown- and bridge-work. I teach them in the order named, arranging so that the didactic instruction in plate-work will be completed the first year, and crown- and bridge-work the second year. The technic work is nearly the same. The crown technic is finished the first year, beginning the bridge-work the second year. All technic work is to be finished about the middle of the second year, when the entire time from 9.30 in the morning until noon is devoted to practical work, in plate, crown and bridge, and orthodontia, for the remaining year and a half.

In technics, verbal instruction is confined to very short talks telling the class what to do and how to do it. This instruction is also written upon the blackboard in as concise terms as possible. The desire is so far as possible to have the student become familiar with the technic of a given subject before it is considered in the lecture-room. By this means the student knows what we are talking about and the lecture is of vital interest, because it explains why he did so and so, also why he met with certain difficulties and how he can overcome them. The student having some knowledge of one method, it is much easier to present other methods and make them intelligible to his mind. It is a most important factor in didactic teaching to so drill the student that he may have an operation or process described and be able to put the ideas into practice. This mental grasp is to my mind the chief difference between the school- and the office-educated young man. To illustrate, we will consider the subject of impression-taking. This is the first technic work the student is given to do. After he has spent a few days in taking impressions and making plaster casts, his mind is in a receptive condition to grasp all we have to say upon impression materials and methods. In fact, he is quite sensitive upon the subject. It should always be borne in mind that the large proportion of our students are not accustomed to lectures. We give a definition for an impression, as, "A negative likeness of an object or a part to be reproduced in form." It is not sufficient that a definition shall be repeated two or three times, but it must be analyzed: "An *impression* is a negative, not positive; the object is to produce the positive and have a perfect reproduction in form, or a *cast*."

Another very important thing at this time is to teach the student how to take notes. Without this instruction the probability is that the student will never read what he has taken, and would not understand it if he did, because the notes would be fragmentary. I instruct the student to draw a perpendicular line about one inch from the left side of the sheet. I then instruct him to write all subjects on the left of the line,—in a word, if possible,—the subdivision and short notes on the right.

In the first two or three lectures I write out the notes upon the blackboard as I am lecturing. Then for a few lectures I mention the subjects, divisions, and subdivisions,—when I feel that all who are interested in taking notes have established a method. To illustrate: The subject, "Impression," is written upon the left of the line; then opposite, at the right of the line, is written the word *Defined*. As this definition is not found in the text-book I request the students to write it out. The one word reminds the student that a definition was given, and if he does not remember it and it is not written out he must look it up in his text-book. Upon the left write, "Materials." Opposite, "First" and "Second." *First* Materials softened by heat; and *Second,* those made into paste with water and hardened by crystallization. (Name materials after each.) Then each material is treated as a subject, as, Wax,—treated under the subdivisions: How obtained, chemical symbol, solvents, melting-point, adulterants, how made into sheets, how removed from cloth, how worked; and so on through the list. The result will be that the student will have the teacher's notes, with almost no time consumed; he has not lost the connection; can at any time review the lecture, and it creates a demand for his text-book.

Another feature to be considered is the keeping of attendance. I use this method, and like it better than any with which I am acquainted: At the close of the lecture I pass slips of paper about three by four inches in size; I give several to the man at the end of each row of seats; he takes one and passes the rest to the next man. I then ask for a short classification, definition, or the spelling of a technical term, which they write, sign their name, and hand in as they pass out. This requires but a moment of the class time and is an index to the comprehension of the student as well as a record of attendance. The name is afterward checked off in a book.

The subject of quizzing requires careful consideration. I believe that it should be used as a method of teaching and not as a form of examination. I give two lectures a week prior to the holidays, and one lecture and one quiz per week after New Year's. I may at any time during a lecture ask a question, but this is designed to fix the attention upon the point under discussion. My reason for not introducing the quiz earlier is that the class may have covered all of plaster, vulcanite, and some of metal plate-work, so that the student has some knowledge of the general subject of prosthesis; then the quiz becomes a review, and the student associates ideas which he did not do on first going over the subject. At the beginning of the term the student's mind is so engrossed with histology, osteology, and chemistry that it is wrong to require a preparation for a quiz upon this subject. The various subjects are taken up and quizzed upon in the order in which they were lectured upon, hence the student knows what to prepare.

Formerly my whole object in quizzing was to teach, and the students, knowing that it made no difference with their percentage, would sometimes take advantage of the method. I have known a few men who would persistently respond, "I don't know." I noticed that these men were very assiduous in writing down the question and perhaps a short answer. I have this year announced that a record will be kept and for "poor" to "very poor" recitation five to fifteen per cent. will be deducted from their final examination.

It is my opinion that the technic, didactic, and practical teaching should be entirely in the hands of one man; the technic and practical work may be in the hands of assistants, but they must be in entire sympathy with the professor, they should be men that have been educated to the work under him, so that no conflicting methods will be introduced.

By these means we will have harmony, and "In union there is strength."

DISCUSSION.

Dr. GRANT MOLYNEAUX. The very excellent paper presented by Dr. Wilson I think appears at a most opportune time. In a measure the paper is disappointing, in that it does not deal with prosthesis, as I see it, in any particular. I have made a few notes since receiving the paper, and I will try as briefly as possible to make myself clear as to what I consider prosthesis. If there is any department of dentistry at the present time that, more than the others, needs special attention from the intelligent part of the profession, it is that of dental prosthesis. The paper contains very many good suggestions, especially regarding the attitude of the teacher toward the student; how to impress him professionally, and how to find out what he knows and what he does not know. To know your students is a very important item in the teaching of any department of dentistry. After a brief perusal of the paper I am led to believe that the essayist has fallen into the error of many others, in that, judging from his text and his illustrations, he is teaching matters which are wholly mechanical as dental prosthesis. The melting of wax, dissolving it, molding it into sheets, the softening of modeling compound, and all other matters of this nature pertaining entirely to the dental laboratory, are matters that should be taught as dental mechanics, not as dental prosthetics.

I believe that, for the welfare of the students, we should as teachers perfectly define the subject now under discussion. We have in the college with which I have been connected a department of prosthesis, and we teach the mechanics of prosthesis, dental mechanics, orthodontia and palatal prosthesis pure and simple, and the making of splints. The connected mechanical matters, the construction of appliances, etc., may be left in the laboratory, and may be under the head of prosthetic dentistry, but they are not prosthetics. Orthodontia cannot be mentioned in connection with prosthetics, nor the making of splints, nor the treatment of cleft palate, unless coupled with the substitution of artificial teeth. By such a division we attach to the term dental prosthetics a special significance, in that it means the substitution of artificial teeth, and involves the constant knowledge of the conditions that obtain with the patient,—not in the laboratory, but with the patient. The substitution of teeth involves many principles: health, comfort, function, restoration of function, as far as possible, contour, and all of that. These are things that must be considered incidentally to supplying function, which is the main objective point. The man who handles the patient at the chair takes an impression, and sends it two squares away and has a model poured. (I use the word "model"; Dr. J. Bond Littig has used the word "cast," and I tried to make a distinction once in that regard, but I fell from grace. I think the word model is much better to use than the word cast.) The model comes back; he molds a wax plate over it, builds up a bite of wax and sends it back for the teeth to be set up and the plate finished. It comes back and he places it in the mouth. Who is the prosthetic dentist,—the man who made that plate or the man who is putting it in the mouth? I say the man who made the plate is the mechanic; he can't be anything else, and he assumes to treat a case which he has not seen. The man who put that plate in the mouth is the prosthetic dentist. Mechanics is only conducive to the requirements. Health, comfort, restoration of function, conservation of tissue and all that that implies, must be uppermost in the mind of the man who is handling the patient, and he must know how to trim that plate; he must know where to bring his bearings. This is an important item. Mechanics may be made conducive to the requirements by careful and thorough mechanical technics.

Didactic instruction has been placed by the essayist as of greatest importance in developing the true professional man and in imparting underlying principles. "Technique and practical methods develop the artisan." Yet I observe that the essayist ends the lectures, which he considered of such great importance, with the first year, continuing the technique and practical methods which produce the artisan into, and well through, the second year; then he takes up orthodontia. It has been my experience that the first-year students are not, as a body, capable of grasping any but the most elementary principles. I have been informed that in some schools the freshman is not admitted to the prosthetic clinic, *i.e.* where he may see the demonstrator handling the patient, or may by observation get some idea of the tissues of the mouth or general characteristics of the face. In this case the discussion of principles would have very little value; they could not possibly make an impression upon a student. If he is allowed to enter the clinic while the handling of the patient is entirely in the charge of the demonstrator or the professor or his assistants, his attention will be attracted to certain conditions. After such a clinical course, and a thorough technical training, the mind of the student is prepared for, and can be impressed with, a discussion of some of the principles which should apply to dental prosthesis; and these subjects should be illustrated as far as possible. I believe in the second year didactic instruction will be of greater benefit than in the first year. Recitations in this department I believe, with the essayist, to be of little benefit, except that after considering principles which we would take up in the second year, we *might* assume a hypothetical case and have the students discuss that case in the room. Now, you call on any student to discuss that case, and if he doesn't start right, the professor calls him down and gets the next one until someone does start it right. Quizzing is always an important factor in teaching, and a quiz should be prepared and used judiciously. I agree with the essayist in his general statement that the lecture, the quiz, class-room demonstration, etc., are methods that should be employed in teaching prosthetic dentistry, or in leading up to the teaching of that branch.

We are now about to enter upon a four-year course, and it appears to me that if we ever hope to place this department on the plane that it deserves, we must arrive at a more uniform method of teaching, as to subject matter and as to when the several subjects shall be taught. And above all, that in the teaching of any of these departments or divisions we shall use a more definite nomenclature than that expressed by the essayist. I do not believe that a prescribed course should be laid down, *i.e.* so far as to prescribe the hours in any department, the number of lectures, the number of quizzes, etc., but I do believe that we can harmonize to some extent upon a proper division of the subject and of the matters taught under the heading of prosthetic dentistry. The method to be employed in presenting these several matters to the students must be left to the individuality of the teacher or teachers. The illustrations given by the essayist of his method of teaching are valuable because they are suggestive. I will use one of them because it will enable me to enforce the thought uppermost in my mind in this discussion, *i.e.* the necessity for a more accurate classification. The essayist says, "My object in not introducing the quiz earlier in the class is that the class may have covered all of the plaster, vulcanite, and even metal plate work, so that the student has some idea of prosthesis." I would like to ask Dr. Wilson if he can teach students to make dentures of gold or vulcanite and handle patients in three months of instruction. Is it possible?

Dr. Wilson. I start them, but they are not finished by any means. They do not handle the patient.

Dr. Molyneaux. It is not possible for me to teach students to do that in that length of time. I have been teaching for quite a number of years. I never was able to make a student in three months able to take hold of a patient and take an impression and construct a piece of prosthesis. If Dr. Wilson means the mechanical operations involved in prosthesis, or that will be later applied to prosthesis, that he has performed in the laboratory with vulcanite and brass on dummy models, then I say he is teaching only mechanics, and the subject should be handled as dental mechanics, not as prosthetic dentistry. If you impress the student with the necessity of accuracy in performing each mechanical step, telling him that each small detail will have a bearing in the final construction of that denture, he will look forward eagerly to the time when he can study the mouth and when he will be instructed how to modify and apply his technical instruction to the practical insertion of a piece of prosthesis. At this time the thorough discussion of the underlying principles will be of immeasurable value. The lecture, as such, is of very little importance, to my mind, during the first year, so far as prosthesis is concerned. But I do most emphatically believe in a thorough course of mechanical technics, employing all forms of every conceivable variety of base or material, so as to acquaint the student's mind with the mechanical details of handling these materials, and pointing out from time to time some little practical point so as to keep his mind anticipating something further, until he has been trained to know how materials should be handled so as to produce accurate results, so far as mechanical manipulation is concerned. The method I employ has been to cover the freshman, junior, and senior years partly with instruction. I am supposed to be the professor of prosthetic dentistry, but I do not treat of palatal prosthesis, orthodontia, or splints as dental prosthetics. We take up the vulcanite base; we construct as many forms as I can imagine so as to give the technique of the apparatus and materials employed, but it is not called prosthetics, because a student takes it only from dummy models. The junior year is devoted, of course, to technical crown- and bridge-work and lectures on the principles of dental prosthesis. In this course we illustrate with models and charts and with a lantern, and use as many phases of the mouth as we can produce from our past experience that will act as suggestive measures to the student in the future.

In Cincinnati Dr. Webster presented a model of flexible vulcanite, and I had some words to say in connection with that subject on another line. So far as I know, Dr. Webster presented for the first time to the profession flexible vulcanite for the purpose of teaching the use of separators and the use of rubber teeth. At that time I said that I had used roller compound. I believe the first time that roller compound was presented to this society was by myself four or five years ago, and the first time that I have any knowledge of the presentation of roller compound was by Dr. Templeton in 1889, and since that time many will recognize that I have used roller compound for the duplication of models. I have here a model which I made yesterday afternoon to illustrate what I mean by phases of the mouth, and I say that flexible rubber, as suggested this morning, used in the prosthetic department as suggesting a principle, will not hold. It is all right in the operative department, but if you want to demonstrate a principle mechanically, so as to impress your students, you must have something that will reproduce the conditions of the mouth as nearly as possible. I give this model to the student and say, "Take this model and study it, and then apply the treatment of relief to prevent fulcrums and so as to insure adaptation and the proper bearings, etc.; take this and follow out the lectures and study it."

I have done that, and it was presented by me years ago at the state society meeting in Ohio, and also at this society several years ago.

The last half of the senior year is given to instruction mostly on the artistic side of prosthetic dentistry and to palatal prosthesis and instruction in continuous-gum work, every point of which is illustrated in every step through the different operations. And when I speak of the artistic side I do not mean that I talk about temperamental relation, but I show faces and show edentulous jaws and show the different physiognomies, man and woman, and give some suggestive ideas of the modification of the rules, as to how they must be modified to suit the various physiognomies. Dental splints, etc., are also taught, because I have had some training in that line, and I teach them in connection with some other things, but I only teach the mechanics of splints. We try to present as many varieties of cases as possible, with conditions as near as possible to those in the mouth, and supplement this with clinical training at the chair. The method employed by the essayist to keep a record of attendance at lectures seems to be very good. So far as note-taking is concerned, some students can take full notes and others cannot. To make this matter uniform to the class, and in the freshman year, especially, where you cannot lay down absolute rules in prosthesis, but in mechanical work, I append a little squib on vulcanite. The student takes a full upper model, constructs a base and a denture and then gives the successive steps of that; and then a full lower, and then finally supplements that with a list of the instruments and apparatus used. To make this matter uniform for the class the blackboard is used, and after each demonstration these steps are placed on the blackboard.

In concluding this discussion I feel that it would not be out of place to repeat a sentence from an article by W. S. How upon the mechanics of dentistry. "Word meanings change or vary through customary or incidental usage, therefore the thoughtful speaker or reader has not only to select words for his purpose, but he should be definite in attaching to certain phases of words the precise significance that each word is designed to impart." I believe this suggestion is opportune at this time.

Just one other thought. Dr. Guilford said this morning that it is not difficult to find teachers of prosthetic dentistry, but that it is difficult to find teachers of chemistry. I would like to ask Dr. Guilford if he can point out a good teacher of prosthesis. I will say that prosthesis is not understood; there is not a more staggering subject in the dental profession to take hold of. I will say there is a great deal to prosthesis, and I know little about it. I am trying to know something about it, but it is a very deep subject and I like to take the broader view of it.

Dr. H. M. Kirk. In Dr. Wilson's paper there is much to commend and but little with which to take issue. In his first paragraph he has made a statement which I think is marvelously near the truth. He says, "In my own mind I am satisfied that the teaching of prosthesis is the most important subject in the dental college curriculum." The late Dr. Bonwill often made the statement that the mechanical skill and manipulation, such as is needed and developed in the dental laboratory, is the very basis of successful dentistry. But prosthetic dentistry is a much neglected and subordinated department of dentistry. It is neglected by the dental profession in general; by the student in college (after he has passed his initial year), and even by the college itself. I might have stated the fact more correctly if my declaration had begun at the other end, and I had named the college first, then the student in college, and then, as a result, the dental practitioner. I am not putting it too strongly to assert that there is too great a tendency on the part of the college and the laity to gaze admiringly at operative dentistry as through the right end of an opera glass, while they glance disparagingly at the prosthetic branch through the same glass reversed, and seem to see nothing there of very great attractiveness or importance.

This is not as it should be. These two great copartners of dentistry should stand abreast, and move aggressively forward. Prosthetic dentistry is the peer of operative dentistry, and, when indicated, is just as important. Making a denture is just as respectable, just as useful, just as remunerative, as filling a tooth or constructing a bridge; and to-day there are effulgent bridges in many mouths where there should be partial dentures. There is no excuse, in an effort to subordinate prosthetic dentistry, for asserting that, because all effort should be directed to saving teeth rather than replacing them with substitutes, operative dentistry is greater than prosthetic dentistry. That saving teeth is better than ruthlessly destroying them, no one will gainsay; but so long as there are edentulous mouths, or mouths partly so, where bridges are contraindicated, just so long prosthesis should be and must be practiced. It is just as important, then (in these particular cases), and just as necessary, as the most perfect filling or the most beautiful bridge; and should be executed according to the most approved methods and in the most skillful manner.

It is not a valid excuse, nor always an honest one, for neglecting prosthetic dentistry that operative work is clean work, and prosthetic work is less so. It may be true; but is prosthetic work any less clean than the mechanical part of bridge-work? Made in the same room, nearly the same materials used, with the same surroundings, and perhaps at the same bench and lathe. Few men making that plea will refuse to make a bridge, or several of them, if the opportunity offers. What a man is able to do, he generally likes to do; and what he likes to do, he is generally able to do well. The main reason, I believe, that the average dentist does not like prosthetic work is, that not understanding it and its principles well, he has but small success in practicing it, and consequently he very naturally fails to fall in love with it, but would seek a divorcement from it. True, our tastes, our capacity, our mental endowments differ. Some students will not, others cannot, learn prosthetic dentistry.

Many students in colleges, many of our laity, and a greater number of those to whom we might refer as dental charlatans, not understanding the beautiful principles underlying this class of work, have very vague ideas as to what really constitutes an artificial denture. They are apt to think of a set of teeth as a piece of vulcanized rubber, made over most any kind of an impression, with a few artificial teeth upon it, arranged in a horseshoe shape, thereby hoping for good luck; no thought of esthetic taste, or of the other features which should be identified with an artificial denture. As for metal dentures, they have none to make, nor could they construct one if they had an opportunity. It has never been intelligently and sufficiently demonstrated to them that there are underlying and cardinal principles which govern the construction of an artificial denture, just as there are in filling a tooth or making a bridge. Many times, in the college laboratory, have I seen an awakening on the part of the student to the real science and beauty of prosthesis; as he was being assisted individually through the mysteries of a practical case, he saw more in mechanical construction of the jaws, arrangement and articulation of the teeth, than he had ever dreamed of before. With the knowledge of these comes to a great degree the ability to use them successfully. It is in the province of the college to awaken the student to the beauties, possibilities, and profits of prosthetic dentistry. Ay, it is the college's duty! But it can never be done so long as the college fails to provide the means for doing so.

The essayist, with all of us, realizes the great responsibility resting upon the teacher of prosthetic dentistry during the first year, but seems to fear lest the dental youth develop into "the other extreme, a mere mechanic." Fortified by the other first-grade studies, I am not afraid that too much mechanical ability or artistic taste is likely to be infused into our students,—at least, I have never yet seen a serious case of it. On the other hand, I have wished many times for an exhibition of greater accomplishment along that line.

The essayist says, "The lecture we place as the most important of the didactic methods for producing professional men." The statement should be qualified. The history and successes of many institutions of learning, both literary and professional, will not bear out this unqualified statement. Much also depends upon the branch of learning taught.

But very little prosthetic dentistry can be taught the student unless he can carry out in a practical way the principles promulgated in the classroom. Precept upon precept, line upon line, here a little and there a little, must be applied to technical and practical work, else he will not learn to make a successful denture. Evidently the essayist does not believe as strongly as I do that teaching should involve much "seeing things done." For he asks, What mechanic could not do a thing which he had seen done? He himself indorses the idea. I believe that "seeing a thing done" is valuable. There should be more individual demonstrating in our dental college system. Were I to teach a student prosthetic dentistry on one line, either by didactic methods or by individual technical instruction in the laboratory, I would choose the latter. As we are to use both methods, the more individual technical instruction we give the student the better it will be for him!

The essayist raises his voice against the recitation plan, but approves of the quiz system. I cannot see but that they are essentially the same. If the quiz be a good system, as the doctor admits it to be, then the recitation plan should not be condemned; for both systems (1) Strengthen the memory of the student and stimulate study; (2) Administer to his mental alertness; (3) Keep him trained in detail work. I believe that in many studies in the dental college, and more studies in the medical colleges, the recitation plan will bring the best results. In our own college, where the recitation plan is used almost exclusively in the classroom, our students are uniformly successful before examining boards wherever they go, even many before entering the senior year. This is due to the detail work in the recitation plan. The essayist says: "It always impresses me that the recitation applied to mature minds is an acknowledgment of inability and unfitness upon the part of the teacher." While our students are not kindergartners, at the same time we cannot assume that they are of mature mind. Quite immature I regard them, especially as far as their chosen profession is concerned, at least during the first two years at college. If the recitation be the best plan for immature minds, then it should be a success during the first two years at college.

The student must know his lesson *well* before he can rise in his place before a company of fellow students, and answer the questions put to him by his teacher.

I *do* believe that the opportunities for successful recitation in prosthetic dentistry are limited, when compared to many other branches taught, and our own judgment and experience should be our mentors. A short period for recitation and review, each day of class, I believe to be better than waiting till after the holidays, as has been suggested by Dr. Wilson.

He says, speaking of practical work, that "Perfection in this department is in one sense the aim sought by other methods, and can justly be considered the last step in making the finished operator." I would like to emphasize this. But at this point the college itself has a duty to perform. I refer, first, to the equipment, and second, to teaching corps. By necessary equipment I do not mean a lot of worn-out vulcanizers and knock-kneed lathes, and other equipment which was only ordinary in its palmiest days. The demonstrators should be employed on account of the largeness of their knowledge, experience, and personal fitness, and not on account of the smallness of the salary for which they may be employed. With Dr. Wilson, I believe that they should be men of character, able to inspire in the student admiration for themselves, as well as for the branch they are teaching; *men*, in full sympathy with the plans and desires of the professor, not men who would in any manner hinder him, or make slighting or suggestive remarks about him, in the hearing of the students. With the demonstrators, it must be remembered, more than with the professors, lies the responsibility of training the student to be a dentist unless the professors be given the opportunity of being their own demonstrators, with an able assistant or two, which plan I believe to be ideal.

As does Dr. Wilson, we use the blackboard for defining the steps in all requirements. One requirement at a time, step by step we go, the whole class moving through this requirement-tactic much like a military company on dress parade. Thus it becomes to the student a gradual unfolding of a beautiful theory, which later on will surely enlighten their realm of practice. We need painstaking teaching, not grinding out requirements as quickly as possible, in order to get them off our hands. There is a disposition to teach prosthetic dentistry in too short a time. The first year is not too long to teach vulcanite work in all its phases, arrangement and articulation of the teeth, and thus allow metal work to form a part of the second-year work.

The practical work of the college lies usually with the junior class, although it belongs properly to the senior year as well. But the average senior is far above prosthetic work. He lives on a higher plane, a more ethereal habitation, in a world of operative, and crown- and bridge-work, which best suits his tastes and capacity. It being, then, almost impossible to have the senior come down from this lofty perch, the practical and technic instruction of the student in prosthetic dentistry really ceases with his junior year. Up to this time he may have made two or three practical cases in prosthesis. By the time he has finished his senior year, he has inserted fifty or seventy-five fillings of all kinds, and several bridges. At the end of the college course, in what department of work, do you think, is he most proficient? Certainly not in prosthetic work, unless his instruction has been of the best.

In general, vulcanite work forms the great bulk of artificial dentures. Hence the first year devoted to vulcanite should be very comprehensive, and but little metal work should properly be done in that year.

I like Dr. Wilson's note-book system, and too much cannot be said or done in support of the taking of notes systematically. Dr. Wilson says, "The subject of quizzing requires careful consideration. I believe that it should be used as a method of teaching and not as a form of examination." But he concludes the paragraph with the statement of a system of merit-marking which practically makes his quiz an examination after all! But this is right. Recitations should embody both ideas, examination and teaching, and marks of merit should be given, which may have a bearing upon the student's work for the year.

Dr. Wilson's method of keeping attendance is unique, and undoubtedly efficient, if not too bulky. It is a move in the right direction.

A summary of the main points would be:

(1) The acknowledged importance of prosthetic dentistry, both *per se*, and as a help in development of manipulative skill in all departments of the dental art.

(2) The duty of the college to the student, in providing the proper men as instructors, from the standpoint of ability, experience, and character.

(3) The duty of the instructor to his students and to his college, in devising the best plans for teaching and in using any or all methods that his judgment and experience dictate.

(4) The use of technic work, and plenty of it, as a preparation for the more important practical and professional work.

(5) The systematic taking of notes by the student, with leaves gleaned from the instructor's book of experience.

Regarding and interpreting these to the best of our ability, we will do wonders in the uplifting of this department of the dental art, and in rescuing it from the hand of dental prosthetic charlatanism.

Dr. A. O. Hunt. I want to be as brief as possible, because I always notice the same condition when the subject of prosthetic dentistry is up for discussion before a body of dentists, or even dental teachers, and that is that it is wearisome. It calls out little or no interest outside of those who have been engaged in its teaching; the rest don't like it, they don't care for it, they haven't the slightest interest in it: I desire, however, to make a statement, which, whether it be true or not, is my conviction,—that it is impossible to make a good dentist unless he be grounded thoroughly in the subjects that we classify under the name of "prosthetic dentistry." I don't care what specialty you may choose to practice, prosthetic dentistry is absolutely essential to the success of a dental practitioner. The evidence in the history of the profession is ample to prove that statement beyond any question. All the great men that we have had in the profession, with but one exception that I know of, have laid that foundation in the laboratory and along the lines of practical laboratory experience.

Now then, what are we here for? What are the colleges organized for? They are supposed to be able to give better training than a student can obtain in an office; it should be better. Our sole purpose is to make a successful, competent, thorough, well-informed dentist who can take care of the human family, and bring comfort and satisfaction to it by improving the condition of the oral cavity. We have but two subjects to teach as the final ending and rounding up of all our work, comprehended under the titles of prosthetic and operative dentistry. (We have lately grown to a specialty in orthodontia; also oral surgery has always been more or less of a specialty.) But our purpose is to make dentists. Hence, I say, whether it is true or not, it is my conviction that it is an utter impossibility, from my experience, to make a dentist until you teach him thoroughly, systematically, everything that comes under the head of prosthetic dentistry. I am not going to discuss and define the different reasons for it, but the freshman student comes to you to become a dentist. What of prosthesis, what of restoration of the human face, what of the final ideas or purposes can you teach in the freshman year? Nothing. You must teach what? He is starting in to become familiar with a class of material that he has never touched before. If it were simply the manipulation of that material, he could learn that in an office just as well as anywhere else, but we are teaching chemistry, metallurgy, anatomy, and all of these other sciences around this main purpose, and everything that is taught in these branches that can in any way be of assistance in bringing the freshman student to a clear understanding of the material that is used, is all that you can accomplish in the first year. There is no science in that, further than that all things are scientific that deal with facts.

Now, then, teach him everything there is to know about the material he is going to use: why we use plaster of Paris instead of something else; why we use ordinary beeswax. We use modeling compound,—it is made up of various substances that he is not familiar with. All of this the student in his freshman year should understand thoroughly, not only the chemistry, but to know exactly what each substance is in its chemical and physical characteristics, and why it is used. I don't care how you teach it. The essayist says we start the student with impression work. What's the use of starting with impressions if you have not a well-defined purpose in view? He is not going to take impressions of the mouth to make dentures for some little time. If he does anything, let him do it for a purpose. If he takes an impression of a fellow-student's mouth, he gets a model of the human mouth, with the natural teeth in position. Now here is the keynote to dental prosthesis,—to know the position, the relation, the arrangement of the natural teeth. And here is the first thing he sees of dentistry, the model that he makes from that impression, and so far as I can judge from the essay, that is the end of it. The only purpose, seemingly, is that he shall put some material in another student's mouth and get an impression and make a model, and then it is laid away. In teaching the use of these materials you should have a purpose in view, *i.e.* teach step by step why they are used. By and by he will make a full denture. He is going to arrange some teeth for that denture. What is his guide going to be? If you want him to carve a tooth, you give him a tooth to imitate, you give him some idea of what he is going to do. Now, why not use these models that he has made and in duplicate cut the teeth off one of them. It is immaterial what kind of a model he works on; it is the idea of illustrating to him the human teeth as they stand in the mouth. But here his next-door neighbor may have a set of teeth with some peculiarity about it; let him imitate that.

And when in his second year he comes to where he begins to deal with the patient, he is not yet ready to be taught what is necessary in the restoration of the human features, because he has not studied those things. Here is the time, however, to begin the application of his anatomy, the function and location of every muscle of the face until he becomes familiar with how they operate. The study of the character of mouths,—as Dr. Molyneaux has set out here a flexible model which indicates the conditions which he finds in the human mouth; as he has also said, here is the time to instruct the student that he must not destroy tissue. Every mouth, gentlemen, is a study. There is no possible way that I know of whereby you can teach a student to make one denture, having made which he then knows how to make any other. Every case that he treats, every case that he comes in contact with, is of an individual character, and in his second year is the time that the instructor should point out to him some of the things that he is going to carry to completion when he knows something of prosthetic dentistry. One of the papers said that probably prosthetic dentistry was the least thing that any graduate from a dental college knows, and unfortunately that is true. Now what? Is it the fault of the student? Do you think it is? I say No. There is no class of student material that goes into any occupation that compares with that which enters a dental course. Did you ever think about it, gentlemen? There is not a tool or an instrument used by any artisan of which we do not use the counterparts,—not one. It is necessary, then, to teach students how to use these tools.

The study of the human face he comes to in his third year. The human individual stands up before him as something to deal with; he begins to realize that he must do something to make that individual at least as good-looking as he was before he lost his teeth. Now we come to the art of prosthesis, pure and simple. Everything before this has been technics or mechanics, all of which is just as important as anything that is taught. He must study the human family in what relation? Here is a room full of people, and if there were twins here it would make no difference, there is constant variation. Now what are you going to do? If you make a set of teeth for an individual, you must make it to suit that individual. Away back in the beginning of your work in the freshman year you have had the student begin the study of these conditions, all the way along using models for teaching purposes that were taken by him from actual conditions. You cannot in any other way have the student understand. You do not understand yourself without that kind of study what it means to arrange a set of teeth. They are not all alike,—they vary; positions vary, conditions vary, variation is the constant law. More than that, it is possible to demonstrate to the students in their senior year, and not before, that there is an absolute relation between the face, the lips and cheeks, with the position of the teeth in the mouth; there is a positive relation to be demonstrated. This is dental prosthesis; the restoration of the human face to its normal condition.

We are all the time discussing method. I wouldn't give that much for method! Any man in this room will find a method if he knows the principles. I will trust any dentist that I ever saw in my life to make such a thing just as well as you or I can make it, if he knows what he wants to make. He won't follow the same method that you do and it won't make any difference! Look back through the profession. Plenty of men that you send a patient to will construct an artificial denture that is satisfactory, and yet you ask that individual to tell you what he did and he cannot do so. He has learned how to do it under great difficulties, persisting for years and years before arriving at the point at which he could take any patient and make for him a satisfactory denture. Now, gentlemen, the science of dentistry rests upon more than that; that is technical skill; we all have plenty of it. We can invent; we can make any sort of a thing, as was said in the paper, if we see it done. Now I have no criticism to make, but I would rather be compelled to think about things. You must think out the principles. The whole system of education of the world rests upon that. We are in a narrow field; we are following within narrow lines; we are not reaching out and getting familiar with the systems and principles that underlie the educational systems of the world. There were those long before we became teachers who found out what was necessary to draw out the human mind for the purposes of education. The writer says that the teacher should never be a taskmaster. Well, who is to be the taskmaster if not the teacher? Who is the man to hold a student down to his work, to make him do it just as he is told to do it? The student is not the judge of what he is to do. So far as laying down any method or way of teaching is concerned, that seems to me like an impossibility. Each teacher must find his own way of conveying to the mind of the student the ideal that he has in view. If he has no ideal, he had better not teach; if he has one, he will find his own best way of imparting that knowledge to the student.

The essayist also made a criticism on the recitation and quiz. Our president in his address defined, at least to my idea, what I think to be the purpose of a quiz, *i.e.* to find out what the student does not know, not to find out what he does know. The recitation system, however, if carried out properly, has a purpose that has not been mentioned. The great difficulty with dental students, in my experience, is to get them to read. They don't like to read; they don't like to study; they are perfectly willing to have you show them anything. Now the recitation system is a means whereby the student is compelled to read more, perhaps not as much as he ought, but it is a means that will urge upon him the necessity for reading more than he would if you confined it entirely to a quiz. So far as the grading or standing that you may give a student is concerned, that is a personal matter.

The question was brought up as to the relation of orthodontia and prosthesis. The finger manipulation of individuals is often discussed. Of course, it goes without saying that a dentist must have this kind of instruction. In the making of appliances, no matter what they may be, they have necessarily been classed under the branch of dental prosthesis, without in any way meaning that it is prosthesis, only that that is the general term used now throughout the colleges to express a certain department; it used to be mechanical dentistry. Thank the Lord we got rid of that, but there still remains too much of the mechanical idea. But, gentlemen, it seems to me that whatever fault there is lies with us and no one else. There must be something wrong here; there must be something wrong in the teaching. If it be a constant thing that students going out of dental colleges can sustain themselves creditably in every other part of our work except dental prosthesis, then surely something is wrong. And there are only two things that we teach, leaving aside the other points that I have mentioned, and those are operative and prosthetic dentistry. We don't teach prosthetic dentistry as well as the operative people teach operative dentistry, and that is where the fault is. We don't understand our subject so well as they do. It is a larger field; it requires the teachers of that subject to go out into all the fields of science, nearly, to get the material to use and apply it to this little narrow profession of dentistry.

Dr. W. C. BARRETT. Dr. Hunt thanks God that he is rid of the idea of mechanical dentistry. I feel that there should be a distinction made between prosthetics and mechanics in colleges. They are confused. I like the old word mechanics. I love a mechanic. I wish I were worthy the name of a mechanic. There is nothing in the world I admire so much as when I send for a workman to do something about my house which requires mechanical skill and he does it in a strictly mechanical manner. A plumber will come and make my home almost uninhabitable because he is not a mechanic. There is a vast difference between prosthesis and mechanics. Prosthesis means the substitution of natural tissues or organs by artificial ones. Crowns and bridges are spoken of here as belonging to mechanics. They are strictly speaking prosthetic work. The artificial teeth themselves are prosthetic appliances; the plate which sustains them is entirely mechanical, unless it is used for the substitution of a lost alveolus, or other missing tissue. A wooden leg belongs to prosthesis; an artificial velum is prosthetic; a glass eye is prosthetic. But I like the old idea of mechanics to express technic skill and manual dexterity, and I wish the dentists would use their language with better discretion than they too often do at the present time, and that they would not speak of prosthetic ability and skill when they mean mechanical expertness. Dr. Molyneaux made the proper distinction. So did Dr. Hunt in one moment, and then the next he thanks God that he is able to abandon it. He takes pride,—and so do we,—in the fact that he is something more than a mechanic. With all the sanctity of the pious Mussulman, who at noonday alights from his camel and spreading his prayer rug upon the burning sands of the desert, kneels with his face toward the holy city and with uplifted hands cries, "Allah! O Allah! In this shadeless land thou art my shelter," so does Dr. Hunt, in the honest fervor of his professional sanctity with uplifted eyes thank God that in this land of mechanical pretenders there is a sure refuge for the professor of facial art. I would that his devotion, sincere as it is, were more properly directed, and in that aspiration let me enter my protest against the pagan worship of prosthesis, and here erect an altar upon which I may make my sacrifices to the mechanic arts and the mechanical idea in dentistry.

Dr. S. H. GUILFORD. Dr. Barrett is perfectly right when he draws the line of distinction and gives a definition in regard to what prosthesis is. It is the replacement of a lost natural part by an artificial appliance. Dr. Molyneaux did not seem to think so, for his idea was that it requires something artistic. It may or may not. You construct a crown or piece of bridge-work and it is prosthetic work; it is the restoration of a lost part by means of an artificial appliance. It does not necessarily imply that the one who makes the part must do it in a thoroughly artistic manner. With his idea in mind, Dr. Molyneaux asked me if I knew of a single prosthetic dentist in this country. Of course I do. We have men in our profession in this country who have true artistic ideas. You probably knew Dr. Essig, of Philadelphia, Dr. Kingsley, Dr. W. W. Evans, and others that I might mention who were or are artists in their way. They were not only prosthetic dentists; they studied the ethics of facial expression, and their highest ideal was the construction of an artificial appliance which would so restore the lost expression of individuals as to make them appear as nearly as possible as they did before their natural teeth were lost. That is the highest type of prosthesis. We haven't a great many of that kind, but I believe the time is coming when we will have more.

Dr. Hunt said that what he wanted was the teaching of these principles; he cared nothing for method. I don't understand that. He certainly must have some regard for method. You can't put a boy into a machine shop and tell him to do a piece of work without instructing him how to do it. That might develop individuality, but before you develop individuality you want to develop mechanical ability, and when the student comes to your college you must say to him, "I want you to do this thing in such a way," and then after he learns to do it in that way he may learn to do it in some other way. When students are placed in the laboratory I want them taught just how to do a certain piece of work. I want the demonstrator to say, "Do this in a certain way," and they are obliged to do it in that way. Why? Because it is a good way. It is not the only way. After the student learns to do the work in one way he can try some other way. We all recognize the fact that it is impossible to take a student into the clinic and teach him to fill teeth in a great variety of ways. We haven't the time. It wouldn't do to say to a beginner, "I want this tooth filled; I will give you a certain amount of gold that I want adapted to the walls of the cavity," etc. You must teach him how to introduce the first, second, and third pieces and all the rest, and after awhile when he becomes familiar with one method he will do it in some other way, and, as I said before, his individuality will eventually develop, so that, after all, method is at the bottom of it. We wish to teach all we can, but we must do it in an orderly way.

In regard to the teaching of prosthetic dentistry, I am glad to see that the essayist and those who followed him had in their minds the system which we have employed in our school for a long while, and that is, during the first year the student is taught how to do things mechanically. He doesn't see a patient. He is taught the use of tools, and how to do certain things, such as the making of experimental plates, etc., simply the mechanical part. That is the foundation. Then in the second year he studies the other part of it,—his relation to the patient and the individuality of the patient as related to the plate. First the foundation is laid in regard to dental mechanics. Our students are taught by the demonstrators who are over them in a comprehensive way what they are to do and how they are to do it, but they don't attend didactic lectures upon prosthetic dentistry until the second year. By that time they are able to appreciate the principles involved in the lectures. They learn the mechanical or technical part first and after that the practical portion with both the patient and operator as important factors.

Dr. A. O. HUNT. I do not want to be at all misunderstood. I wouldn't have you think for a moment that I disregard method. I simply said that I think each teacher will find a way of his own, but it is essential that one method should be taught to students all the way through in order to be systematic, explaining various other methods, but I really think that a professor should have a definite line of teaching to be followed as the one he wants. To that extent I am a great admirer of method, but I think too much stress is placed on it, and not enough in compelling students to understand principles better.

Dr. J. D. PATTERSON. I wanted to rise to my feet to state my approbation of the sentiment which has been expressed in relation to the pre-eminence of the prosthetic field of dentistry as compared with the operative. As I look at it, much of the best in operative dentistry is prosthetic. The highest of operative dentistry, which we class usually as prosthesis, belongs to the fine arts. The highest in art is sculpture, then music, then painting, and so on. In the restoration which we do in prosthetic work we approach the very highest, that of sculpture. The highest form of the fine arts is the reproduction of the human form divine, and when we do that in the mouth, then we are artists. And there is no question about the pre-eminence of the fine arts in the prosthetic part of dentistry, when compared with the operative. When we do the best that we can in prosthetic work we are able to make more mistakes than in the operative, and more fault can be found with the best result that it is possible to attain than in the operative. A great many refuse to do mechanical work because so much complaint follows even their best efforts. That is a thing that we must not pay any attention to, and I am very sure that I do not. I appreciate the prosthetic field and the difficulty of well rounding out that field. It requires more study, more painstaking, and more sleepless nights than any field of operative dentistry a man ever entered. And all that is of the highest in fine art in operative dentistry belongs to the field of prosthesis.

Dr. G. H. WILSON (closing the discussion). I thank you very much for the consideration of the paper. I believe this is the only paper so far in which we have been successful in having our good brother Barrett called out.

The first discusser was a little more inclined to splitting hairs than we expected, although we expected that, but we would like to have consistency. He made the distinction between mechanics and mechanical methods and prosthesis, and that the mechanics and the steps leading up to it should be taught in the first year, and then the finishing part the second and last year; and then he tells us that in the third year he teaches prosthesis and continuous-gum work. It strikes me that that is pretty near mechanics, just as well as vulcanite. But the idea should be that we must use means to accomplish an end, and of course we began at the beginning and worked up. The object was not to try to cover the whole ground, because prosthesis is an extensive field, but it was simply to state the beginning and leave something else for the rest to say, and we feel that it has been very nicely said.

THE TEACHING OF BACTERIOLOGY.

By W. R. BLUE, M.D., D.D.S., Louisville, Ky.

The addition of bacteriology to the dental curriculum did not cause delight to the prospective D.D.S., and the teaching of him or her is no easy task. I do think, though, that in a short time the dental student will manifest as much interest in this branch as does the medical. I was much gratified, at the end of my course this term, to hear a number of my pupils say that they were sorry the course was over, as they were beginning to be interested in the subject. But all good things must have an ending!

To teach any subject successfully requires, first, the necessary equipment,—which I have, thanks to the directors of my college. Second, the attention of the student. This can always be gained by plainness of talk and demonstrations. Blackboard demonstrations in connection with the work at hand make the course all the more interesting to the student. Third, in bacteriology one must have pure cultures, good microscopes, good objectives, good stains, and last but not least, good light. Cut-and-dried specimens should not be used in demonstrating, except as a control of the bacteria under consideration.

After explaining the work in view in a general way to the student my first lecture covers cleanliness, the use of high-power objectives, condensers, light, preparation of cover-slips and slides to render them sterile, and the articles required of each student in the laboratory, such as stains, needles, labels, Bunsen burners, etc. After this the course is about as follows:

I. *Definition of Bacteria.* History of bacteria, touching on their minuteness and giving measurements in micro-millimeters.

Grouping. They are classified by their shape, *i. e.* globular, cocci, rod-shaped bacilli, curved or spiral spirilla.

General Morphology. Here we describe the structure of the bacterial cell. Bacteria are examined under the microscope in their natural state and stained to bring out their protoplasm and envelope.

II. *Reproduction.* Now is explained the rapidity of reproduction under favorable surroundings. Board demonstration of the method of reproduction is given, also of degenerative changes, such as involution, explained.

Spore-Formation. Board and microscopic demonstrations of this method are given, Bacillus tetani and Bac. anthracis, properly stained, being used.

III. *Motility.* Movements of bacteria are studied by use of hanging drops. Here flagella are explained and the part they take in producing movement in bacteria. No attempt is made to stain flagella in the course, as the time required to find them by every student in the class would carry us far beyond the time allotted to the course.

General Biology of Bacteria. Under this heading we speak of the growth of bacteria, calling special attention to the prime factors which must be considered in their growth: (1) Food supply. (2) Moisture. (3) Relation to gaseous environment. (4) Temperature. (5) Effect of light.

IV. *Death of Bacteria.* This is demonstrated by transferring dead bacteria to fresh media and their failure to grow. The subject of germicides, sterilization, and the part these play in killing bacteria, is touched upon here. Sterilizers of various kinds are shown the class.

V. *Preparation of Culture Media.* Under this heading the making of different culture media is explained. Culture tubes are shown in the sloped, upright, and deep form,—the last for cultivating anaerobic bacteria. Platinum needles, for inoculating tubes, are passed to class and their use explained. Also methods of separating aerobic bacteria by use of Petri dishes and Esmarch tubes.

VI. *Incubation of Cultures.* Incubator with gas-regulator and burner brought before the class and explained.

VII. *Non-Pathogenic Bacteria and Pathogenic Bacteria.* (A)

Non-pathogenic Bacteria: The higher bacteria are placed under this heading, Leptothrix racemosa and Penicillium glaucum being used in hanging drops and stained for demonstration. (B) Pathogenic Bacteria: Before taking up the study of pathogenic bacteria, the student's attention is called to the importance of destroying all infectious articles either by heat or chemicals. No food is to be eaten in the laboratory. Smoking is prohibited. No label is to be licked by the tongue. When fluid containing bacteria is spilt on the benches or floor 1:1000 mercuric chlorid is at once poured over the spot. Barring the Bacillus coli communis, only mouth-bacteria are dealt with in the course. All the varieties of pus-producing organisms are first shown and the part they play in suppurative conditions explained. These are followed with the thrush fungus (Oïdium albicans), diphtheria bacillus, tubercle bacillus, and actinomyces. Then come the bacteria that cause dental caries: (1) The acid-producers of superficial layers, *i.e.* Streptococcus brevis, Micrococcus albus, aureus, citreus, Spirillum sputigenum and Bacillus maximus buccalis. (2) Of deeper layers, *i. e.* Staphylococcus brevis and Bac. necrodentalis (Goadby). The liquefying bacteria of dental caries are next shown, *i. e.* Bac. mesentericus fuscus and Bac. fervus (Goadby) and yellow bacillus of Goadby. Only one bacillus that produces discoloration in caries is shown, *i. e.* Bac. mesentericus ruber.

VIII. *Microscopic Examination of Bacteria.* The two methods used are by hanging drop and film preparation; the first I have already referred to. Film preparation, dry method: This is the most common method of microscopically examining bacteria. The student is given a drop of sterilized, distilled water on cover-slip from platinum loop. Immediately afterward the bacteria to be studied are added to the water and stirred. Student evaporates the moisture and passes the cover-slip through the flame of the Bunsen burner three times to fix the film. Then the stain for the bacteria under consideration is announced, with full direction for its use. When practicable, each student is given specimen to examine suspected of containing bacteria he is studying in pure culture. (I make use here of pus from alveolar abscesses, sputum from suspected cases of tuberculosis and thrush.)

IX. *Inoculation of Animals.* When time permits, animals are inoculated with some of the virulent cultures in stock. After death, post-mortems are held and pathological changes in different organs are made note of. Blood is examined for bacteria.

X. *Immunity and Susceptibility.* These subjects are treated at some length. Under this heading toxins and antitoxins are explained.

The last week of the course is devoted to the inoculation of culture tubes by each student, from particles obtained from the mouth. These tubes are labeled and incubated. Cultures are examined at the end of the third day by hanging drop and film method. Pure cultures, previously stained, are used as controls.

At the end of the course a general review occurs, when the micro-projector is used for the larger bacteria and lantern slides for the smaller.

DISCUSSION.

Dr. L. P. Bethel. As Dr. Blue has asserted in his paper, it is no easy task to teach the subject of bacteriology understandingly. The majority of students know nothing whatever about the subject, and some have never heard of it until after entering college. It therefore seems to take a longer time for them to begin to comprehend this subject than any other branch taught in the dental course. Taking advantage of this fact, we begin the study of bacteriology in the Dental Department, Ohio Medical University, in the freshman year, devoting one hour a week throughout the year to recitations and supplemental talks, and begin the laboratory course in the junior year. By pursuing this plan the student has a clear comprehension of the whole subject before he begins his laboratory course, and he then goes to work understandingly and learns more from this practical laboratory work than he otherwise could. The students also do more creditable work in the laboratory.

In the freshman year the subject of bacteriology is taught in a general way, beginning with definitions and explanations as to what bacteria are, etc., followed by a short history of the discovery and study of them up to the time of the birth of modern bacteriology in the early eighties, and the progress made from that time up to the present. The subject is taught progressively, the blackboard and charts being used wherever their use seems an advantage. After covering the subject in general, bacteria of the mouth are considered, the necessity for antisepsis, fermentation in the mouth, ptomain formation, and infection from the oral cavity explained, cultures made from the mouths of students are grown and passed around for inspection, etc. Twenty-seven hours are devoted to recitations, demonstrations, and talks on this portion of the work, three and one-half months being given to general, and three and one-half months to special bacteriology.

At the beginning of the junior year the student commences the laboratory course. Each day an outline of the work is placed on the blackboard for students to copy into their note-books, and an explanatory talk given the class.

Following is an outline of the laboratory course given: Preparation of the different culture media. Study of hanging drop. Staining methods, simple. Staining by Gram's method. Preparation of Petri plates. Study of Petri plates. Preparation of pure cultures. Study of non-pathogenic bacteria. Study of pathogenic bacteria. Staining of spores and flagella. Examination of air, soil, or water. Study of normal mouth-bacteria. Ferments and fermentation in the mouth. Plate studies from pyorrhea alveolaris, abscess, and other pathological conditions of the oral cavity. Studies of bacteria found in caries of the teeth: (a) superficial layers; (b) deep layers. Growth and study of aerobic and anaerobic forms of bacteria found. Sections of decalcified carious teeth stained and studied. Caries of teeth further elucidated by means of lantern slides and projection.

Cultures studied in the laboratory are: Subtilis; prodigiosus; Kiel; rubidus; sarcina aurantiaca and lutea; fluorescence; proteus vulgaris and mirabilis; mesentericus vulgatus; Deneke; Finckler-Prior; Friedlander; pneumococcus; streptococcus pyogenes; staphylococcus aureus, albus, citreus; pyocyaneus; gonococcus; coli commune; typhoid; actinomyces; cholera; tuberculosis; diphtheria; tetanus; malleus; anthrax; lactic acid; yeasts; molds; and bacteria known and unknown found in the mouth.

The bacteria are studied on the different media. Diphtheria, on Loeffler serum. Pus cocci are isolated from pus by the students. Tuberculosis is studied from the sputum; anthrax by rabbit inoculation; tetanus by inoculation into mice, etc.

Realizing that you desired only an outline of the methods of teaching the study of bacteriology, I have purposely omitted much detail, but this is a general survey of the course taught our dental students, and covers twenty-seven hours in the freshman year, and eighty hours in the junior year, making a total of one hundred and seven hours devoted to the subject.

Dr. George W. Cook. The essayist has very clearly and concisely given us his method of teaching bacteriology. He is the first medical man, doing work in dental schools, who has shown any special connection of bacteriology with dental teaching. Most all the teachers in the so-called scientific branches in dental schools have been in the past, and are very largely at the present time, recent graduates in medicine, many of whom are not even well acquainted with the common routine technique of laboratory work. For instance, I obtained culture media prepared by four leading medical schools, and found that the ordinary saprophytic bacteria would not grow with any degree of success, excepting one. I later learned that the janitor was making the culture media for these schools. A senior student from one of these colleges is now an assistant in one of our dental schools in bacteriology. The dental schools take one or two men of this stamp as teachers to dental students.

A teacher should be able to place before the student not only growing bacteria, but the cause of putrefaction, fermentation, and disease, remembering that two factors are ever present, the substance to be acted upon and the active agent. One of the points that should be brought out to dental students and explained is the phenomenon of anaerobiosis. Upon this question rest some principles of fundamental importance to the student, who will have ever before him the problems of fermentation and disease. This will lead far into the food question of bacteria, and the chemical means of destroying them. It is only necessary to give a few examples here. For instance, the non-pathogenic bacillus prodigiosus produces red pigment on substances, rich in starch, but if the temperature be raised a few degrees, a strong lactic acid fermentation will take place instead of the red pigment. The comma bacillus of Asiatic cholera causes disease in man, but when grown in sugar solution it produces lævorotary lactic acid and is non-pathogenic. The germ of butyric acid will produce butyric acid out of saccharose as a chief product, and butyl alcohol as a by-product. But when the germ is grown on media containing glycerin, butyric acid and butyl alcohol as a normal product (and as a by-product propyl glycol and lactic acid) are formed. A great many more examples might be given similar to this of the physiological activities of bacteria. This is of the greatest importance to students in dentistry. Since bacteriology is one of the most prominent branches of the tree of knowledge, it cannot be neglected or slighted in dental schools.

When Paracelsus spoke of the seeds of disease, he must have had a foreshadowing of this bacterial question. When we consider that bacteriology is just struggling through from the natural history stage to that of a science, it is more readily understood why the true biological principles of pathology have been, and are to-day, so very imperfectly understood. One can very materially simplify his way of treating diseased conditions if his knowledge is based not only on mechanical but on scientific physiological principles. We can, from a clinical and experimental standpoint, say conclusively that there are chemical agents that cure disease, and that the inductive method is the only way in which it can be taught to students.

A student should start his bacteriological work in his junior year and should have completed the principles of histology and physiology. He should have had the elementary structure of a proteid molecule well fixed in his mind, thus giving him a good knowledge of how living things are built up out of the simple elements. He will then be able to grapple with the principles of the vital phenomena of bacteria, and their action on the chemical compounds with which they come in contact. Under this head will come the processes of putrefaction and fermentation, the latter of which the dental student should have well grounded in his course in dental education. The mere fact of growing bacteria, without thoroughly understanding the chemical activities and the metabolic changes they produce in the environing media, is not sufficient to give him the proper knowledge for the combating of disease, which is to be his future life-work. A teacher should grow such bacteria as will enable him to show all of these various processes. This will be considered by many teachers as entirely too much work for the limited time allotted to its study.

When the student comes to his senior year, he should have a pretty thorough knowledge of disease, and the bacteria that he has to combat in practice. It is easy to teach him pathology, giving him a thorough understanding of those germs known as parasites, and their action as disease-producing organisms, at the same time teaching him the difference between those low forms of vegetable life, known as bacteria, and those parasites that belong to the animal kingdom, known as protozoa; explaining the difference between their disease-producing functions, while you are showing that the last forms here mentioned cannot, as yet, be cultivated artificially as bacteria. When this is done, we will begin to place the subject of bacteriology on a scientific plane, where it belongs, and the subject of pathology will then be on a scientific biological basis. As long as dental schools are placed upon a commercial basis, so long will dentistry be considered an art instead of becoming a progressive scientific profession. The sciences have everywhere struggled through a mechanical and sometimes a monistic stage, and to-day dentistry is on the borderline between a science and an art.

The question of text-books I have not mentioned. This is one of the stumblingblocks in the teaching of bacteriology and pathology. The only text-books that it is possible to use at the present time are those on general bacteriology and pathology. We want a text-book from a man who has had at least ten years of study and experimental knowledge along with teaching these subjects. A book cannot be used written by a man who has scraped a small particle from a tooth and sent it away to some laboratory, and called this a scientific analysis of the subject in question. A book could be gotten up, containing three hundred and fifty or four hundred pages, which should not cost a student over three dollars, but this is going to take an immense amount of research and the study of the literature that is constantly being brought out from the laboratories all over the world.

Gentlemen, I do not believe so much in the extension of the time of study for students as in the extension of time and preparation of the teachers who are to teach these students. A teacher in any of the scientific branches should devote, at the least calculation, not less than one-half of his time to teaching and study. What can we hope from a teacher,—say, for instance, a busy practitioner in dentistry or medicine? The medical man who has three or four cases of typhoid fever and perhaps six of diphtheria cannot give much time to reason out why the streptococcus chains grow longer in the saliva of one person than in that of another; to the future dentist this will mean a great deal.

These remarks are not intended as a reflection on our essayist, for I know him to be a painstaking bacteriologist, and in his paper he has shown himself to be ambitious in giving the students of dentistry the very best knowledge possible.

Dr. W. C. BARRETT. The curriculum of dentistry has broadened and widened so much within the last few years that it is no wonder that it is necessary to extend the term. Human research is adding so much to human knowledge that the short time employed in teaching dentistry in the past has been entirely insufficient to do more than give a superficial glance at the technique of a few of the studies which the dentist should pursue.

Bacteriology lies at the base of pathology. It is but a few years since the first instruction was initiated in pathology, under the old two-year system of instruction of about five months, taking two weeks to pry the thing open and two weeks for vacation and two weeks to screw it shut, left about three months of good solid instruction to the student in each year. All of the pathology that was taught was included in the chair of operative dentistry. At the present time most of the schools have established a chair of pathology, and the dentist is taught that he is, to a certain extent, pursuing medical science; that he belongs to one of the great curing arts; that it is his business to cure disease and to wipe out that which induces changed pathological conditions. This is a wonderful change within a few years. If the dentist is simply a mechanic, he is no more a professional man than is the shoemaker. The dentist, if he is simply a mechanic, must understand something of the anatomy of the human mouth and teeth; that doesn't make him a professional man. It is when he begins to study the curative art and to treat pathological conditions that he rises to the level of what is commonly conceived to be a professional man. By that I do not want anyone to understand that I belittle this mechanical portion; that is one part of dentistry.

Bacteriology lies at the base of most of the pathological changes that take place in the oral cavity, hence no man can practice the dentistry of to-day and comprehend the dentistry of to-morrow unless he has pursued a good course in bacteriology. It is one of the basal studies, or should be one of the basal studies in the pursuance of a dental course, as much so as anatomy is in its own field. I don't mean to introduce any comparison between them, but I say that in pathology a study of bacteriology is as essential as a study of anatomy is to the pursuance of surgery. It is a considerable number of years since I began to teach didactic bacteriology. I never have prepared myself or made any special studies in the technique of the laboratory courses. My own course has been to commence the study of bacteriology in the junior year, giving the didactic work at that time, and a full course of lectures, as competent a course as it was possible for me to deliver on the strict subject of bacteriology, going back to the very classification of matter and taking up the roots which underlie and permeate the basal structure of the whole study. Then in the senior year comes the laboratory course. With that I have never connected myself. I have been teaching the didactic portion of bacteriology in the Chicago College of Dental Surgery for a number of years and the laboratory course has been carried on by someone else. It is the same thing in Buffalo, practically. There the laboratory course is taken in the senior year. I believe it belongs in the senior year. When we get to the four-year course it will be in the sophomore and junior years, but at present I think it belongs, from my standpoint, in the junior and senior years. Unless the student is thoroughly versed in the elements of mechanical science and becomes fully acquainted with the basal principles in the freshman year, he never gets it. He gets to the junior year and there are so many other things to take his attention that he will not devote his time so exclusively to the mechanical aspect of it as he should. When he gets to the senior year it is out of the question. Hence the freshman year with us, is mainly devoted to the elaboration of the mechanical portion; the junior year commences the scientific study, and the senior year gives the laboratory course. And, gentlemen, there is no study which is taught in either of the schools with which I am connected which seems to absorb the attention of the students so much as does that of bacteriology. There is none in which they are so greedy for information, so far as my knowledge goes There is no study, so far as my knowledge and observation extend, to which they devote themselves with more enthusiasm than to bacteriology.

I am very glad to have listened to the paper, and also to have listened to the discussion arising from it. When shall we as teachers rise to a comprehension of the fact that dentistry is growing, spreading wider and wider, and that the courses in dentistry require a preliminary education that shall enable the student to comprehend the basal principles of science; that he shall not learn his A B C's after entering the dental college, and that he must be thoroughly instructed in all of these principles which are so absolutely essential to the pursuance of any professional course? I tell you, gentlemen, we don't half comprehend it! We are just engaged in our own field, and that which is nearest our eye excludes the light from that which is farther away. I tell you we have to take broader views; we have to become wider and more comprehensive in our studies, and to remember that a dentist is no longer a tinker, he is no longer a bellows-mender, but he is to pursue scientific studies along those lines so closely intermingled with the basal principles which he must understand, as bacteriology.

Regarding the last paper that was read, I am inclined to think the author has fallen into the error of a great many. He is a little puffed up with the idea that he is a bacteriologist, and the impression produced upon my mind was that he rather attempted to confound us with a multiplication of technical terms which were very badly expressed and prevented our getting the sense of what there was in the paper, provided there was any sense there. I wish that we would, as dentists and as everything else, use the English language. We can't avoid using technical terms, but what is the use of calling a spade an agricultural implement when we will so much better comprehend it if we speak of it as a spade? And when we use a complication of technical terms, with which so few of us are familiar, there is a mixing up, there is a shadow over our meaning; it is completely involving outside matters with that which should be comprehended, so much so that it becomes as clear as mud sometimes. I wish that everyone who writes on such subjects as this would use common-sense language and common language and use no more technical terms than they are obliged to.

I believe the first paper to be a very careful and clear statement of a good, competent bacteriological course which is sufficient for the wants of to-day. To-morrow we will want a postscript, we will want another addition, because we will have advanced and we will have become able to comprehend and understand higher, better, more complicated things.

Dr. G. V. BLACK. I would like to add a word to this discussion, and in the outstart let me say that we should not blame the bootblack if he converts a verb into a noun and uses it in expressing his intentions when he says, "Have a shine, sir?" It is the language of his craft, and we readily come to understand him. Now, gentlemen, let us apply this to dentistry, and when we teach dentistry let us use the language of the craft, and if we do not understand that language it is our fault as dentists. In other words, when we name things in dentistry, whether it be in operative dentistry, whether it be in pathology, or whether it be in bacteriology, let us use the language of that subject. In no other way will we be enabled to understand it. If we do not understand the names of things that are applied in that subject we will fail to understand it.

Dr. BARRETT. Let us not pretend to use technical terms when we do not understand them.

Dr. BLACK. There are some who do know them. Unfortunately, there are many who do not yet know them. Let us learn them, and we, as a profession, will not learn them until those of us who do know them call things by their right names, nor will we understand the things of which we speak until we call them by their right names. Gentlemen, I stand for a better understanding of the nomenclature of these subjects, that this nomenclature should be taught as we name things that we present to students,—name them correctly, that is all. Not that nomenclature should be taught so much as a separate study from the things we are teaching,—that is not the right way,—but to present the thing and properly name it as we present it. This is the way in which to teach nomenclature in connection with any subject. And in this subject of bacteriology, particularly, we are greatly at fault for want of careful pursuit of the nomenclature that is handed down to us. Here is one of the difficulties I have found in following our esteemed Dr. Miller. It has always been a source of great discomfort to me that he failed to name the bacteria of the mouth as he went on with his work. I understand full well the reason why he did not do so—the difficulties that were in the way, the difficulty of selecting suitable names, and yet it has been a stumblingblock ever since,—the fact that he did not give to the specific bacteria which he isolated and determined, specific names which we could apply. If we had these names sharp and clear and the diagram of the different organisms written out in sharp and clear terms, we would have much less difficulty in studying the flora of the mouth to-day. I wish we had these names. I have been compelled myself to give them names such as would answer my purpose, understanding with myself that these were more or less temporary, and I have avoided in a degree using them in the general writing that I have made on this subject, because I felt that they were necessarily temporary.

Now as to the specific course that should be pursued in teaching bacteriology in dental schools. We have much more than we can do at the present day to give students a fair idea of the flora of the saliva, and it has been my thought that we should confine our work pretty closely to this flora. I feel that we are going too much into the general pathological bacteriological work to give our students the time they should have in the study of the flora of the saliva. There is a reason for this in the lack of text-books. The text-books that are available to our teachers are the text-books of general pathological bacteriology. We have not as yet a text-book that we can follow in the studies of the mouth and from the mouth, and yet I should prefer to take my students into that field, even with a lack of text-books, than into the general field of pathological bacteriology. The teacher who can isolate and point out these organisms, the several organisms that are of importance, and there are not so many of them, will have done good work. It is true that Dr. Miller has isolated some sixty or more varieties from the saliva, but we know very well that these are gathered from day to day as we are passing through the street, as we are passing from room to room; they are gathered in the saliva and come out in this cultivation; they will be mostly the ordinary saprophytic micro-organisms. The division of these from the pathogenic organisms of the mouth, those that may produce caries, inflammation, pus, is an interesting field to the student; particularly does the isolation of those that produce acids, taking them directly from the students' mouths or from the patients in the infirmary, become a field of the greatest interest to the student. And then the student should learn something of the conditions that arise in the mouth directly as a result of their growth, from a direct study of the mouth and cultivation from the mouth. It has been my habit in the cultivation before my class to take almost the entire list directly from the mouths of my students in the class and let them see the results of these growths as illustrated in the lecture course in bacteriology. It is easy to do this. It takes a little time, but when one gets hold of it so that he may change an alkaline medium into an acid medium by planting from the mouth of the student, showing the change in color by the use of litmus, and various things of this kind that will interest the student, that will have a teaching force, it will in this way do the student much more good than a general survey of general pathological bacteriology.

In examining the courses given in these papers we find that it is almost exclusively the course given in the medical schools in the general pathological bacteriology, rather than a course selected for the dental student to illustrate the general principles of bacteriology in the mouth. We will not cultivate from the mouth long until we find the principal organisms, and very soon we will find that we have a very large proportion of the list that is important to us in the general field of pathological bacteriology. We will show in this way the presence of these disease producing micro-organisms in the field of our own work. Instead of taking them only from the laboratory, then, I insist that we isolate them directly from our own field of work. Why not isolate the bacteria from carious dentin; why not isolate them especially from the deeper portions of carious dentin, and show our students what is going on there, in this short course that we must give them?

Now, I would urge upon those who are teaching bacteriology in dental schools that they take these freshly extracted teeth with actively progressing caries, and isolate the micro-organisms from these, make the general or mixed growth first, then plate them out and get the individual species from caries, get the individual species from about the necks of teeth, the individual species from the masses that grow about children's teeth, from young adults' teeth and from old persons' teeth. Get the variations among these; then in the broader methods we may illustrate those micro-organisms that do not grow upon culture media. Here is a field of work that is so neglected that I wish to speak of it particularly; for we have, as most of us well know, a number of species of micro-organisms growing in the mouth habitually that are undiscovered by methods of culture and by the ordinary microscopic examination, because of their transparency, because of their failure to take color by the ordinary staining methods. By the special plans, however, that have been developed by Dr. Miller we can use special staining methods and get views of these and find that they are growing in profusion in the mouth. I think it is important for students to know that there are micro-organisms not discoverable by the ordinary methods, and also that probably there are many species of micro-organisms growing in and about our field of work that are not discoverable by any method yet known to us. This becomes absolutely certain as we go on, for we find results that are evidently bacterial and yet we are unable to find the bacteria.

Now, I wish to insist upon it that we turn our attention more directly to the immediate field of work in which we are engaged in this bacteriological study rather than take up material exclusively from the general field of pathology.

Dr. J. D. PATTERSON. The work that I do in this field comes after the work that has been outlined in these papers. I take up the function of bacteria in pathological conditions, especially in the oral cavity, and the methods by which we may attain immunity from their growth and action. Dr. Black seems to bemoan the fact that our nomenclature and designation of different classes and subdivisions of bacteria is limited, and says of Dr. Miller that he has criticized him because he does not give us enough indicative nomenclature. Afterward he says that Dr. Miller has isolated and named sixty different bacteria in the mouth. I think he is getting along pretty well.

There is a question upon this whole field which has interested me and which is very seldom spoken about, and that is that bacteria, especially some classes of bacteria, change their power and function. One bacterium with a certain ability to produce disease will, on account of the food or the medium in which it grows, change into another class. To my mind this is one of the most interesting fields which the pathological bacteriological field has brought before us. For instance, a few years ago we had one specific micro-organism in the production of dental caries. Now how many have we? Even Dr. Miller himself acknowledges that there may be four or five, and Dr. Choquet, of Paris, makes the broad statement that any of the bacteria may become acid-producing and caries-producing. Here is a question which is of interest,—that the character of bacteria, what they do in producing disease, depends greatly upon environment and what they consume. When gorged with food, they take on all sorts of forms. Then why shall not a coccus take on the form of a rod, or a rod the form of a spirillum, and so on? I think there is too much attention given to finding a specific bacteria in dental diseases, and that we must in pathological conditions believe that a micro-organism, which at a certain stage in its life and growth has an ability to produce certain destruction of tissue, as the disease progresses the food and environment becomes changed takes on a more destructive character. I don't think there can be any doubt about it. We isolate and we say, Here is a specific bacterium found in a particular form of disease, and we claim it is specific. We do not know.

Dr. G. V. Black. I supposed I was understood when I spoke of the micro-organisms of the mouth and the numbers isolated by Dr. Miller. I want to say plainly, then, that the accidental varieties found here are many; the flora of the mouth proper are few and we may almost count them on the fingers of our two hands. It is not a multitude that we wish to isolate.

As to this matter of change in the species of bacteria. We know that there are certain changes that take place, but the student should learn to know that when he gets the color of the golden rod he has the *Staphylococcus aureus*, and that he can never get that color in any culture of the *Staphylococcus albus*.

Dr. J. D. Patterson. Where in the beginning of the life of that micro-organism did it get its coloring matter?

Dr. G. V. Black. I don't know, sir. There are lots of things we must take as facts in science without an explanation. We know that there are certain species that run through a cycle; all of that is true, but let us not go too far with that and make statements that would confuse students. Here is the insect that runs through a cycle of different developmental stages. We may find the same thing practically among the micro-organisms, and our students should be taught that such is true. But in this running through of these different cycles of existence there is a regular order of sequence, and there is a regular order of the production of by-products in accordance with the material upon which this or that organism grows. But these are regular things; they are not irregular or accidental, and our students should come to know that if I plant the streptococcus media or the "alpha" of Miller in a broth that contains sugar we are sure to get acid as a result. If I plant that in a broth that has no sugar, we are just as sure to get no acid as a result. These things are definite and certain, and they are teachable. We cannot explain the facts, but they are simply definite facts. Then, as there are only about a dozen species, say, of the destructive flora of the mouth that are habitually there, it certainly is not such a large undertaking to develop them for students.

Dr. W. C. Barrett. I would like to ask Dr. Patterson if he habitually, in his teaching, uses the word "eat" in connection with the proliferation of micro-organisms.

Dr. J. D. Patterson. I rise to a point of order. The gentleman is out of order, because he desires to ridicule instead of getting at a point of science.

Dr. A. E. Webster. I am not particularly interested in any department of the discussion, but in the teaching of bacteriology there is one question which arises in my mind, and that is, Should we proceed from the pure culture or from a mixed culture? I thought I had that clear in my mind before I heard some of the remarks, and now I am not so clear as to whether we should proceed from what is actually known, or begin with the mixed culture. It is very essential in a bacteriological laboratory to know which way to proceed, from the general to the particular or from the particular to the general.

Dr. G. V. Black. From a mixed culture, always, as you find it in nature.

REPORT OF EXHIBITS, ETC.

REPORT OF MASTER OF EXHIBITS.

MR. PRESIDENT AND GENTLEMEN:

Following customary precedent, I desire to report the following colleges as having made exhibits, with brief description of each:

University of Pennsylvania.—Teaching methods, illustrating the progressive steps in the prosthetic procedures, plate, crown- and bridge-work.

Louisville College of Dentistry.—Students' work, graded. Printed outline of course.

Indiana Dental College.—Students' class work. Rubber teeth mounted in soft rubber base.

University of Buffalo, Dental Department.—Juniors' and seniors' work; also teaching methods.

College of Dentistry, State University of Iowa.—Mechanical work, freshman year. Teaching methods in the operative procedures.

Chicago College of Dental Surgery.—Freshman and junior exhibit in plate and crown and bridge technics.

Dental Department, University of California.—Metallurgy technics.

School of Dentistry, University of Illinois.—Class work, instruments, carving and dissecting of teeth.

New York College of Dentistry.—Class work, plate, and orthodontia methods.

Pennsylvania College of Dental Surgery.—Teaching methods and class work.

Northwestern University Dental School, Chicago.—Freshman class work, instrument forms, carvings, and dissection of teeth.

Ohio College of Dental Surgery, Department of the University of Cincinnati.—Class work, plates, bridges, crowns, orthodontia.

Pittsburg Dental College, Department of the Western University of Pennsylvania.—Teaching methods and class work.

Dr. Weeks: Papier-maché models.

Dr. C. T. Bryant: Technic tooth forms.

Dr. Barnes: Orthodontia methods.

Respectfully submitted,

H. W. ARTHUR, *Master of Exhibits.*

Improvements in Teaching Appliances.

MILWAUKEE, WIS., December 30, 1901.

DR. GEO. E. HUNT, PRES. INST. OF DENTAL PEDAGOGICS, PITTSBURG, PA.

My dear Mr. President: I find myself, at the last moment, unable to attend the meeting of your association. I cannot however, entirely forego the pleasure of presenting for the consideration of your members two improvements recently adopted in the technic courses of the Dental Department of the Milwaukee Medical College. One of these, a model of which has been sent forward in care of Dr. Cattell, is a flexible rubber cast or jaw devised by Dr. Raymond J. Wenker, in such a way that the sockets are prepared for the insertion of any kind of teeth that may seem best for the student's purpose. We believe that no practice in the preparation of tooth cavities, and filling the same, is so beneficial as that done in natural teeth or their nearest substitutes, in carved ivory. We also feel that neither rubber nor celluloid teeth can be used to equal advantage, therefore in our opinion the ease with which both roots of natural teeth and those ivory carved can be inserted into the sockets of Dr. Wenker's rubber casts and firmly secured, renders this method a decided improvement upon others that have from time to time been suggested along the same line.

The second idea is shown by a crude example, which I send directly to you and which is a result of some experimentation by Dr. Percy B. Wright, of Milwaukee, who teaches prosthetic technics in our college. It is especially designed and used for orthodontia technic work. Teeth can be arranged in any desirable form of irregularity, the tips imbedded in plaster to hold firmly in position, and the flexible material, which melts at a very low temperature, poured about them and allowed to harden. Orthodontia appliances can be adjusted under direction of the instructor, and the misplaced teeth actually straightened by proper application of force. We find it extremely convenient, easily handled by students, and most desirable because natural teeth can be used without injury, while the material, being nothing more or less than modified printer's roller, can be procured very cheaply. Dr. Wright has spent a good deal of time during the past year trying to make suitable change in the crude material. The result is that he can produce it with any degree of stiffness from that of the accompanying sample, which is quite soft, to almost any desirable firmness, and if any of your members feel sufficiently interested, I have no doubt a letter of inquiry will bring the fullest explanation from Dr. Wright. Yours sincerely, GEO. V. I. BROWN.

DR. BYRAM. Last year I promised several members of the Association at Nashville that as soon as I learned of a better method of constructing the *flexible rubber dummies* I would let them know, and I have been asked about it several times since I came. But until Dr. Bryant took hold of the work recently, we had no better method, and I want also to heartily indorse Dr. Bryant's new production of vulcanite teeth.

MINUTES.

SEVENTH AVE. HOTEL, PITTSBURG, PA.,
TUESDAY, DEC. 31, 1901.

THE ninth annual meeting was called to order at 11 A.M., with President George E. Hunt in the chair.

The roll call showed twenty-one colleges present. The total attendance at the meeting was forty-five.

Dr. J. A. Libbey, of Pittsburg, delivered an address of welcome, which was gracefully responded to by Dr. D. R. Stubblefield, of Nashville, Tenn.

The report of the Secretary and Treasurer was read, and referred to the Executive Board.

The reading of the minutes of the last meeting was dispensed with, upon motion, since they had appeared in printed form.

Dr. D. M. Cattell, chairman, reported for the Executive Board that the proceedings and the program of the present meeting had been printed, and were in the hands of the members. President George E. Hunt called the vice-president, Dr. H. J. Goslee, to the chair, and read his address.

Discussion of the address was opened by Dr. J. Taft, whose comments were read by Dr. N. S. Hoff, as Dr. Taft was unable to be present. The discussion was continued by Drs. Kennerly, Stubblefield, Weisse, Whitslar, Barrett, Grant, A. O. Hunt, Webster, Black, Patterson, Kirk, and Hoff, the discussion being closed by the president Dr. George E. Hunt.

The president's address was referred to a special committee, to be appointed later, and to report next year on the subject of "Curriculum."

The meeting adjourned to meet at 2.30 P.M.

2.30 P.M.

The meeting was called to order by the president.

The following resolution was offered by Dr. Willmott, limiting the time of speakers in the discussions:

> WHEREAS, Our time is limited, and straight talking to the point has ever been characteristic of this body; and
>
> Whereas, Dispatch is necessary for the transaction of our business; therefore, be it
>
> *Resolved*, That no one shall occupy the floor more than once to speak on any subject until all who desire to speak have finished, and then only with the consent of the body; and be it further
>
> *Resolved*, That no one shall occupy the floor in the discussion of any subject for more than five minutes, except he ask for and receive the unanimous consent of the meeting, in which case he may then occupy another five minutes only; and be it further
>
> *Resolved*, That the chair is requested to time each speaker and vigorously enforce this rule.

The Executive Board recommended that the name of the Dental Department, University of Illinois, be changed to the School of Dentistry, University of Illinois. Carried.

Minutes of the previous session were read, and after a slight correction were approved.

The symposium on the "Executive Work of the Faculty" was opened by Dr. E. C. Kirk, of Philadelphia, followed by Drs. J. D. Patterson, D. R. Stubblefield, and T. E. Weeks. The general discussion was participated in by Drs. George E. Hunt, J. H. Kennerly, G. V. Black, H. A. Smith, and W. H. Whitslar.

Moved and carried that the subject be passed.

The symposium on "Classroom Methods of Teaching" was presented by Drs. N. S. Hoff, R. H. Nones, and L. S. Tenney. The discussion was continued by Drs. Hillyer, Grant, Weeks, Kenyon, Webster, Owre, Cattell, Byram, and Barnes, and the subject passed.

The chairman of the Executive Board announced that the evening session would be devoted to the paper by Dr. Black.

Adjourned at 5 P.M.

8 P.M.

Meeting called to order by the president.

Minutes of the afternoon session were read and approved.

Dr. G. V. Black then presented his paper on "Management of the Infirmary Clinic in Dental Schools." The discussion was opened by Dr. Weisse, continued by Drs. Grant and Whitslar. The general discussion was participated in by Drs. Bethel, Barrett, Starr, Kenyon, Barnes, Dittmar, Goslee, and Byram, and closed by the essayist.

Adjourned at 10.40 P.M.

JANUARY 1, 1902, 10 A.M.

Meeting called to order by the president.

Minutes of the previous meeting read and approved.

A letter from Dr. G. V. I. Brown addressed to the president was read, and referred to the Executive Board for publication with the proceedings. (See page 158.)

Dr. H. W. Arthur reported, on behalf of the Local Committee, that a banquet had been prepared in honor of the Institute, to take place that evening at the Hotel Shenley, the members being requested to meet in the lobby of the Seventh Avenue Hotel at 8 o'clock.

Vice-president Goslee was called to the chair.

In the absence of Dr. J. H. Hodgen, his paper on "Teaching of Dental Metallurgy" was read by Dr. D. R. Stubblefield. The discussion was opened by Dr. J. P. Buckley and continued by Dr. Alfred Owre. General discussion by Drs. Kennerly, Hoff, Grant, Guilford, and Stubblefield.

Moved by Dr. Cattell that a committee be appointed to draft suitable resolutions upon the death of Dr. C. J. Essig, which was carried. The vice-president stated that such committee would be appointed later.

The Executive Board, through its chairman, Dr. Cattell, reported on some ideas presented in the letter, accompanied by models, from Dr. G. V. I. Brown, devised by Drs. Wenker and Wright.

Dr. Tenney presented models showing results of experiments by Dr. Bryant in making molds in metal for vulcanizing rubber teeth for technic procedures.

Dr. Barnes, of Cleveland, showed model and explained method of making detachable teeth, etc., for technic and orthodontia purposes.

Dr. Weeks showed his mammoth tooth models, and explained their use in teaching cavity nomenclature.

Dr. Hoff exhibited flexible model with vulcanite teeth.

Dr. Webster exhibited models, etc., showing carved vegetable ivory.

Dr. Guilford exhibited bone teeth carved in quantities by professional carvers, and also a metal form of jaws for mounting.

Adjourned.

2 P.M.

Meeting called to order by the president.

Minutes of previous session read and approved.

The president appointed as a committee on resolutions upon the death of Dr. Essig: Drs. Kirk, Barrett, and Weisse.

The application for membership of the New Orleans College of Dentistry was presented, and by *viva voce* vote the college was elected to membership.

Dr. G. H. Wilson then read his paper on "Teaching of Prosthetic Dentistry." Discussion was opened by Drs. Grant Molyneaux, H. M. Kirk, and A. O. Hunt, and continued in general discussion by Drs. W. C. Barrett, Guilford, and Patterson, and closed by the essayist.

The president appointed as a committee on the president's address, to arrange a four-years curriculum, and to report at the next annual meeting, the following: Dr. G. V. Black, chairman; Dr. W. H. Whitslar, and Dr. N. S. Hoff.

The committee on resolutions upon the death of Dr. Essig made the following report, which was adopted and ordered spread upon the minutes:

WHEREAS, This association has learned with deep regret of the death of Dr. Charles J. Essig; and

WHEREAS, By reason of his long and active career as a teacher, and his enthusiastic and energetic efforts to give dignity and high professional status to the specialty which was his life-work; and

WHEREAS, In the death of Dr. Essig this association has lost one of its prominent and devoted supporters; therefore be it

Resolved, That the Institute of Dental Pedagogics hereby places on record the high esteem which they bore for Dr. Essig as a man, and its recognition of his abilities as a teacher. We desire especially to record our admiration for the high ideals which both by precept and example he always inspired and inculcated in relation to dental prosthesis, and which have so largely helped to maintain for that important specialty its true professional relation.

Signed by Drs. EDWARD C. KIRK, W. C. BARRETT, and F. D. WEISSE.

Officers for the ensuing year were then elected, as follows: Hart

J. Goslee, president; J. D. Patterson, vice-president; D. M. Cattell, master of exhibits; H. B. Tileston, secretary and treasurer.

Dr. D. R. Stubblefield was elected a member of the Executive Board for the term of three years, to succeed Dr. D. M. Cattell, whose term expired.

It was announced that the delegates would visit the Pittsburg Dental College at 9 A.M. Thursday morning.

Adjourned at 5 P.M.

(The night session was omitted on account of the banquet given at the Hotel Shenley.)

JANUARY 2, 1902, 10.45 A.M.

Meeting called to order by Vice-president Goslee.

Minutes of previous session read and approved.

The paper by Dr. W. R. Blue on "Teaching of Bacteriology" was read by the secretary, Dr. Blue not being able to be present. Discussion was opened by Dr. L. P. Bethel, and continued by a written discussion from Dr. G. W. Cook which was read by Dr. D. M. Cattell, Dr. Cook being absent. General discussion by Drs. Barrett, Black, Patterson, and Webster.

Dr. H. W. Arthur, master of exhibits, then made a report which, upon motion, was received.

The retiring chairman of the Executive Board, Dr. D. M. Cattell, urged the members to come prepared at future meetings with written discussions of papers, to save the Board unnecessary work. He also asked, in behalf of his successor, for prompt reply to letters, and expressed appreciation of the work done by Dr. H. W. Arthur, master of exhibits.

Moved by Dr. Weeks, That the appreciation and thanks of the institute to the Pittsburg Dental College for the banquet at the Hotel Shenley be expressed by a rising vote; which was done.

The Committee on Operative Technics asked for the addition of Dr. Byram to that committee, which request was granted.

Moved and carried that the Committee on Prosthetic Technics be continued as at present constituted.

The report of the secretary and treasurer was approved as recommended by the Executive Board.

Dr. Weeks then presented the newly elected officers, who were duly installed.

A rising vote of thanks was passed to Dr. D. M. Cattell for his very excellent services as chairman of the Executive Board.

The minutes of this and the preceding sessions were then read and approved, after which the Institute adjourned.

Respectfully submitted,

H. B. TILESTON, *Secretary and Treasurer.*

APPENDIX.

List of Membership Colleges with Duly Accredited Representatives present, dues paid and entitled to vote.

Northwestern University, Dental Department.
College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Royal College of Dental Surgeons.
Dental Department, Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
Dental Department, University of Iowa.
Indiana Dental College.
Kansas City Dental College.
University of Buffalo, Dental Department.
Dental Department, University of Pennsylvania.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery.
Department of Dentistry, Detroit College of Medicine.
Dental Department, Ohio Medical University.
Missouri Dental College.
Dental Department, University of Omaha.
Pittsburg Dental College.
New York College of Dentistry.
College of Dentistry, University of Illinois.
Dental Department, Medico-Chirurgical College, Philadelphia.
New Orleans College of Dentistry.

Membership Colleges without Accredited Delegates.

Dental Department, University of California.
Birmingham Dental College.
Dental Department, University of Tennessee.
Baltimore College of Dental Surgery.

Southern Dental College.
Atlanta Dental College.
Cincinnati College of Dental Surgery.
Dental Department, Marion Sims College of Medicine.
Dental Department, Milwaukee Medical College.
Washington Dental College.

Total membership, 35.

Colleges represented by delegates, 25.

Colleges without delegates, 10.

Colleges admitted at this meeting, 1.

Dropped for non-payment of dues, 1.

Respectfully submitted,

H. B. TILESTON, *Secretary and Treasurer.*

TENTH ANNUAL MEETING of the INSTITUTE of DENTAL PEDAGOGICS held at CHICAGO, December 29-30-31, 1902

REPRINTED from THE DENTAL REVIEW
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AND THREE :: :: :: :: ::

PROCEEDINGS

OF THE

TENTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics

(FORMERLY NATIONAL SCHOOL OF DENTAL TECHNICS)

HELD AT CHICAGO, DECEMBER 29-31, 1902

SEVENTH VOLUME, PUBLISHED 1903

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PREFATORY NOTICE.

THE Publication Committee submits this report of the proceedings of the Tenth Annual Meeting without apology for having made an effort to present only the essence and substance of the discussions, believing that the exercise of such discretion will place on record a fair, liberal, and more interesting statement of the work accomplished.

A careful perusal of these proceedings should stimulate all dental teachers to attend the next meeting of the Institute at Buffalo, Dec. 28-29-30, 1903.

HART J. GOSLEE,
D. R. STUBBLEFIELD,
W. E. WILMOTT.

FORMER MEETINGS AND OFFICERS.

1893, Chicago—President, D. M. Cattell; Secretary J. A. Dale; Committee on Constitution and By-Laws, T. E. Weeks, H. P. Carlton, J. A. Dale.

1894, Old Point Comfort—President, D. M. Cattell; Vice-President, T. E. Weeks; Secretary and Treasurer, J. F. Stephan; Executive Board, T. E. Weeks, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1895, Asbury Park —President, T. E. Weeks; Vice-President, S. H. Guilford; Secretary and Treasurer, J. F. Stephan; Executive Board, D. M. Cattell, 3 years; N. S. Hoff, 2 years; H. W. Morgan, 1 year.

1896, Saratoga—President, H. W. Morgan; Vice-President, S. H. Guilford; Secretary and Treasurer, J. F. Stephan; Executive Board, G. H. Wilson, 3 years; D. M. Cattell, 2 years; N. S. Hoff, 1 year.

1897, Chicago—President, G. V. Black; Vice-President, N. S. Hoff; Secretary and Treasurer, D. M. Cattell; Executive Board, G. E. Hunt, 3 years; G. H. Wilson, 2 years; D. M. Cattell, 1 year.

1898, Cincinnati—President, N. S. Hoff; Vice-President, H. P. Carlton; Secretary and Treasurer, Hart J. Goslee; Executive Board, D. M. Cattell, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1899, Philadelphia—President, H. P. Carlton; Vice-President, Geo. E. Hunt; Secretary and Treasurer, Hart J. Goslee; Executive Board, W. E. Willmott, 3 years; D. M. Cattell, 2 years; H. W. Morgan, 1 year.

1900, Nashville—President, Geo. E. Hunt; Vice-President, Hart J. Goslee; Secretary and Treasurer, H. B. Tileston; Executive Board, W. H. Whitslar, 3 years; W. E. Willmott, 2 years; D. M. Cattell, 1 year.

1901, Pittsburg—President, Hart J. Goslee; Vice-President, J. D. Patterson; Secretary and Treasurer, H. B. Tileston; Executive Board, D. R. Stubblefield, 3 years; W. H. Whitslar, 2 years; W. E. Willmott, 1 year.

1902, Chicago—President, J. D. Patterson; Vice-President, H. B. Tileston; Secretary and Treasurer, W. E. Willmott; Executive Board, R. H. Nones, 3 years; D. R. Stubblefield, 2 years; W. H. Whitslar, 1 year.

MINUTES.

The Tenth Annual Meeting of the Institute of Dental Pedagogics convened under the Presidency of Dr. Hart J. Goslee at the Palmer House, Chicago, on December 29, 30 and 31, 1902.

FIRST DAY.

MORNING SESSION.

The meeting was called to order by President Goslee at 11 a. m.

Dr. G. V. Black, of Chicago, delivered the

ADDRESS OF WELCOME.

Mr. President and Gentlemen of the Institute of Dental Pedagogics:

Nothing could give me more pleasure than to greet the teachers in dentistry of this great country of ours, in which dentistry is making such wonderful progress; where dentistry is leading the world. It is a pleasure to me to look into your faces this morning as you are gathered from the East and from the West; from the North and from the South, thus exhibiting your interest in the progress that dentistry is making, and I hope that the program that has been prepared for you will hold that interest from the beginning to the end of this meeting. I sincerely hope that this meeting will be marked as the most brilliant success which has ever attended the meetings of this association, the first association in the world to make the study of the teaching of dentistry its business. And to this glad beginning I most heartily welcome you.

I welcome you also to this great city of ours, a city that sprang up so quickly on the banks of what was once a little river, a city that the Indian designated as "much big teepee on little river," a city that has grown so wonderfully in its short period of existence. We welcome you to this city and to what it may have in store for you. I must caution you, however, that our chief magistrate and his police force are always on the alert, and if some of you should go a little astray toward the wee small hours of the morning, these ever watchful guardians of the peace will run you in and take care of you. And while the boards at the station may be a little hard, yet the station will be warm.

Our weather man, too, can dish up almost any kind of weather you may desire, and at a moment's notice; furnishing several varieties during the course of one day, if you wish it, so that those of you who come from the sunny South may have frozen weather, and our friends from the bleak North may witness a genuine spring thaw, or any other kind of weather. Chicago is noted for the many kinds of weather it can dish up at a moment's notice, so that you will be both pleased and displeased as to the weather.

Now, we wish you to see and to hear. The different Dental Schools of this city will be glad to welcome you in their homes; the school on the South Side and the two schools on the West Side. Whether or what arrangements have been made for these visits, I do not know, but you will be welcome at any time. Although I have not as yet consulted the deans of the various schools, I think I can speak for them on that point without any hesitancy.

So I again heartily greet you. I am very glad you are here. I am very glad to see the bright and interested look in the eager faces around me, and I hope that during your visit with us you will have a royal good time, as well as do a great deal of good for the advancement of dentistry. Again, gentlemen, I welcome you. (Applause.)

Dr. A. O. Hunt, of Omaha, Neb., responded to this address of welcome, as follows:

RESPONSE.

Mr. President and Gentlemen:

It is always very delightful to be asked to respond to an address of welcome, but it is particularly pleasant to me when that welcome is given in Chicago. There is probably no other place in this country where conditions are so suited for a meeting of this character. We are in the center of what can justly be considered the largest educational center in the United States. And it is a fitting place for an association of dentists and dental teachers, and the fact that there is such a goodly number in attendance here at the very beginning of our meeting makes the welcome doubly pleasing. But a welcome to Chicago involves a great many things. The speaker mentioned the fact of the police organization here being an efficient one. They are very busy and if you should undertake to find any of those Indians over near the mouth of the river that Dr. Black spoke of, you are very likely to run up against a patrol wagon or something of that kind. However, there is no place to my knowledge where the spirit of entertainment is so wholesome, so hearty and so good as in Chicago. Mr. President, we thank the gentleman very much indeed for his hearty welcome to this city. (Applause.)

The Secretary, Dr. Tileston, read his report which was referred to the Executive Committee.

REPORT OF SECRETARY-TREASURER.

Received Oct. 28, 1901, from former Treasurer, H. J. Goslee	$ 58.84
Received dues from colleges for 1901 and back dues	440.00
Received collection charges on checks	.20
Received from H. J. Goslee, to balance account	10.00
Received from S. S. White Co., for stenographer	85.00
Total receipts	$594.04
Expenditures as per Ledger	288.23
Balance in Treasury	$305.81
Colleges admited to membership at last meeting	1
Total membership Dec. 29, 1902	35
Colleges whose dues are paid to current year	30
Colleges in arrears for dues for 1901	5

During the year the secretary sent out letters to all colleges not members of the Institute inviting them to apply for membership and sending each one a copy of the proceedings. Some favorable letters were received in reply but no applications have been sent in.

Respectfully submitted,

H. B. TILESTON,
Sec'y and Treas.

Dr. W. Earl Willmott, chairman of the Executive Board, reported that the program of the meeting had been printed and copies were ready for distribution, and that the proceedings of the previous meeting would be distributed in a day or two. He introduced also the following resolution: "The reaffirmation of the report adopted at the previous meeting, that there be no smoking during the sessions of the association." Carried.

After a short recess, during which the various representatives of colleges were given an opportunity to qualify, the secretary reported that the Keokuk Dental College, of Keokuk, Ia., applied for membership in the institute. This application was referred to the Executive Board.

On motion of Dr. Willmott, the minutes of the previous meeting, as published in the transactions, were adopted. Executive Board also reported that the Constitution and By-Laws had been printed and were on the secretary's table.

At this juncture Dr. Thos. E. Weeks, of Minneapolis, took the chair, while the president, Dr. Goslee, delivered his annual address.

The discussion on this address was opened by Dr. N. S. Hoff, of Ann Arbor, Mich., and continued by Drs. S. H. Guilford, Edwin T. Darby, W. C. Barrett, T. W. Brophy, A. H. Peck, J. H. Kennerly, G. V. Black, D. R. Stubblefield, E. Noyes, G. V. I. Brown and W. E. Grant.

Here Dr. Grant moved that the entire matter of the president's address and the question of curriculum be referred to the committee on curriculum and that this committee report to-morrow when the discussion of the paper is to be continued.

Motion carried.

The Executive Board announced that the special order of business at 9 o'clock to-morrow morning would be a visit to the Dental School of Northwestern University. And that in the afternoon at 4 o'clock the schools on the West Side, the Chicago College of Dental Surgery and the School of Dentistry of the University of Illinois, would be visited.

After listening to a report by the master of exhibits, Dr. D. M. Cattell, the meeting adjourned until 2 p. m.

AFTERNOON SESSION.

The meeting reconvened at 2:30 p. m. and was called to order by President Goslee.

The minutes of the morning session were read and approved.

The roll call of colleges showed that thirty of the colleges members of the institute were represented. The total attendance at the meeting was eighty-six.

Dr. L. S. Tenney, chairman of the Local Committee of Arrangements, announced the arrangements for visiting the dental colleges on the following day, and also gave notice that the banquet would be held on Tuesday evening at 7 o'clock.

The Executive Board, by Dr. Willmott, recommended that the Cincinnati College of Dentistry be reinstated to membership in the institute.

Carried on motion.

The board further recommended the admission to membership of the Keokuk Dental College.

Carried.

The recommendation of the board that a flashlight picture of the association be taken was also carried.

Dr. Joseph M. Patton, of Chicago, read a paper entitled, "Teaching Physical Diagnosis." The discussion on this paper was opened by Dr. R. H. Hoffheinz, of Rochester (who, owing to inability to be present, sent in his discussion, which was read by Dr. Willmott), Dr. T. B. Hartzell, of Minneapolis; Dr. D. R. Stubblefield, Nashville, and Dr. A. H. Peck, Chicago.

The discussion was then further continued by Drs. Whitslar, Weisse and Borland, and closed by Dr. Patton.

On motion of Dr. Brophy, a vote of thanks was tendered to Dr. Patton for his very able paper.

An adjournment was then taken until 8 p. m.

EVENING SESSION.

The association was called to order by the president at 8:30 p. m.

The minutes of the afternoon session were read and approved.

At this juncture Dr. T. W. Brophy addressed the meeting as follows:

"It must have occurred to you all during the previous sessions of the institute that our president was laboring under a great deal of embarrassment. Early in the proceedings some speeches were made, one in particular, before the time limit was fixed, and the chief characteristic of that speech was not only in the many good things the speaker said, but the enormous amount of time he took in saying them. Immediately afterwards there was quite a stir noticeable at the officer's tables, and the president, secretary and Dr. Willmott got together and fixed a time limit of five minutes for each speaker. Everyone who spoke, however, violated that rule by getting someone else, by a little diplomacy, to move that the time limit be extended. So that each speaker had ten minutes instead of five. Then the vice-president came to the chair and declared that the rules must be observed, and said that we should have some instrument by which this association could be controlled. I was called into consultation and I decided to carry out my part of the work.

Here (indicating) is an instrument for our presiding officer, not only for our present officer but also for those to come. It may be remembered that this association had its origin in Chicago, and it was in the Chicago College of Dental Surgery that the first work was done in operative and prosthetic technics. Therefore, we thought it would be quite appropriate for the college to present the institute with this gavel, and on behalf of the Chicago College of Dental Surgery, I present to the Institute of Dental Pedagogics a gavel for the purpose of holding in subjection the members of this most august body. It has been well made of enduring material, and it has been inscribed in a way that will impress those of us who are present at this meeting and, we trust, also who will follow us in the years to come. This gavel bears the inscription, "Docendo discimus"—we learn by teaching—"presented to the Institute of Dental Pedagogics by the Chicago College of Dental Surgery, December 29-31, 1902." (Applause.)

DR. H. J. GOSLEE:

DR. BROPHY, AND GENTLEMEN OF THE INSTITUTE OF DENTAL PEDAGOGICS:

I think that it would be but fitting that this beautiful gavel be accepted on behalf of the institute by one of its originators and organizers, and I therefore take pleasure in calling on one of the fathers of this society to accept this emblem of authority—Dr. Thomas E. Weeks.

Dr. Weeks:

Mr. President and Dr. Brophy:

I recall very vividly a remark I once made at a banquet at which some of you were present and which caused a great deal of merriment. When I arose to my feet to respond to the toast, I said that I was too full for utterance, and I might repeat that remark at this time. I scarcely know how to express my gratification about a number of things. First, and greatest of all, because of this great and glorious association which has grown from a very small beginning that was suggested by four or five, including myself. I hardly know who was the first to suggest it; it has been accredited to me, and not being over-modest, I am perfectly willing to accept all the glory. It was, however, beyond the wildest dreams of its originators that this association should ever wield the power and the influence in matters of dental teaching that it does to-day. I believe it is building and guiding the destinies of the dental profession of this country. I do not believe that I claim too much for the association when I make that statement. We should all, and especially that little band of technique teachers who started this institute and named it the National School of Dental Technics, be proud of the progress that this body has made and the work it has done in furthering the teaching of dentistry in all its branches. That is the first cause for congratulation.

The next is that you have selected me, Mr. President, not a member of this organization by right but only by courtesy, as I am no longer a teacher of dentistry, to accept this beautiful gavel from Dr. Brophy, my very valued friend. Dr. Brophy, on behalf of this society, I thank you and your colleagues of the Chicago College of Dental Surgery for this token of your generosity and good will. Of course, I do not suppose that you meant to insinuate that we were knockers (laughter) by giving us this "knocker."

Mr. President, allow me, on behalf of this institute, to present you, as the presiding officer of this body, with this beautiful emblem of authority. I know you will use it wisely and I hope that your successors will emulate your excellent example. (Applause.)

Dr. Goslee:

As the presiding officer I accept this beautiful gavel with the belief that it will be wielded to the best interests of this body on down through the days of its usefulness which, I am sure, will be many. This is indeed a beautiful gavel and the inscription also is beautiful, and I think it quite fitting that it should be presented to the institute on this its tenth anniversary by the college in which it had its birth. I accept this gavel with a great deal of pleasure, and I assure you that it will be wielded with every effort toward the best interests of this association.

Dr. C. N. Johnson, of Chicago, followed with a paper entitled, "A Systematic Arrangement of Lectures on Operative Dentistry."

The discussion was opened by Drs. W. S. Hosford, G. E. Hunt, H. W. Morgan, read by Dr. Stubblefield, and H. L. Ambler. The discussion was continued by Drs. W. C. Barrett, Smith, Marshall, Black, Stubblefield, Hunt, Grant, Patterson, and closed by Dr. Johnson.

In the absence of Dr. I. N. Broomell, of Philadelphia, his paper entitled, "Teaching Dental Embryology," was read by the secretary, Dr. Tileston.

The discussion was opened by Drs. W. H. Whitslar, J. J. MacKenzie and F. B. Noyes. Others who participated in the discussion were Drs. H. B. Tileston, G. V. Black, W. C. Barrett, G. W. Cook and F. C. Zapffe.

Chair extended cordial welcome to all members of the profession, whether teachers or not, to the sessions of the institute.

Subject passed by consent.

After a report by the Local Committee of Arrangements, adjournment was taken until Tuesday morning at 10 o'clock.

SECOND DAY.

MORNING SESSION.

The association convened at 11 a. m. with the president, Dr. Goslee, in the chair.

The minutes of the previous session were read and approved.

Dr. Tenny, on behalf of the Committee on Arrangements, reported that the banquet was to be held that evening, and that all the visiting delegates were the guests of the local profession.

Dr. Weston A. Price, of Cleveland, O., read a paper on "Teaching Electricity and Its Dental Uses."

On motion the discussion of this paper was deferred until the afternoon session.

Dr. F. D. Weisse, of New York, read a paper on the teaching of anatomy to dental students and illustrated his remarks with lantern slides. Dr. Weisse's presentation was in discussion of Dr. L. C. Borland's paper, and was given at this time because the current for the lantern had been arranged for at this hour only.

The association adjourned until 2 p. m.

AFTERNOON SESSION.

The society was called to order by the president at 2:30 p. m.

The first order of business was the discussion of Dr. Price's paper. The discussion was opened by Drs. L. E. Custer and H. L. Banzhaf, and continued by Drs. T. W. Brophy and F. D. Weisse.

On motion further discussion of this paper was postponed until such time as the Executive Board might direct.

The next paper was read by Dr. L. C. Borland, of Chicago, on "Teaching General Anatomy to Dental Students."

The discussion was opened by Drs. F. D. Weisse and W. C. Barrett, and continued by Drs. A. O. Hunt and W. H. Whitslar, and closed by Dr. Borland.

Upon motion Dr. Borland was tendered a vote of thanks for his excellent paper.

Dr. Black's paper was made a special order for 10 a. m. Wednesday.

EVENING SESSION.

The business of the evening was the banquet which was begun at 7:30, the president, Dr. H. J. Goslee, acting as toastmaster. When the gastronomic portion of the banquet had come to a close the president called the assemblage to order, and with a few well-chosen words introduced Dr. G. V. Black, who responded to the toast, "Past, Present and Future of the Institute of Dental Pedagogics."

Dr. N. S. Hoff, of Ann Arbor, responded to "Preliminary Training."

Dr. S. H. Guilford, of Philadelphia, to "What Shall the Harvest Be?"

Dr. A. W. Thornton, of Toronto, to "Our Canadian Brethren."

Dr. W. C. Barrett, of Buffalo, to "The International Aspect of Dentistry."

Dr. F. D. Weisse, of New York, followed with a few remarks which were well received.

Dr. T. W. Brophy, of Chicago, responded to the toast, "Professional Schools Abroad."

Dr. A. O. Hunt, of Omaha, to "Teaching Methods of the Future."

Dr. B. J. Cigrand, of Chicago, to "Our Guests."

The motion made by Dr. Dickinson that the three original organizers of the association, Drs. G. V. Black, D. M. Cattell and T. E. Weeks, be made life members of the Institute of Dental Pedagogics, was carried unanimously by a rising vote, after which the meeting adjourned until Wednesday at 10 o'clock.

THIRD DAY.

MORNING SESSION.

The association was called to order by the president at 10 o'clock.

The minutes of the two preceding meetings were read and approved.

The Executive Board, through Dr. Willmott, reported that the treasurer's books had been audited and found correct. The board also announced that the Committee on New Appliances would report at 12 o'clock, and election of officers would be at 12:30.

Dr. Geo. V. Black then read his paper on "Teaching Applied Physics."

The discussion was opened by Drs. G. W. Wilson and J. P. Buckley, and closed by Dr. Black.

Dr. J. D. Patterson reported for the Committee on New Teaching Appliances, as follows:

"The first appliance we have to present to you is a method for the introduction of work in porcelain. It consists of a set gotten up for that purpose by Mr. Robert Brewster, of Chicago. We find this a very excellent idea because of the difficulty which we have always met with in getting students started in porcelain work, and this is an admirable way for introducing this work. We have before us the following letter from Mr. Brewster:"

BREWSTER'S INLAY TECHNIC SYSTEM.

This system is devised to aid the teacher in giving instruction in inlay work, and to enable the student to acquire certain manual dexterity in handling porcelain before reaching his senior year. It has for its object—

First. The manufacture of a complete tooth in porcelain.

Second. The formation of cavities in such tooth.

Third. The baking of the tooth.

Fourth. The burnishing of a matrix into the cavity or cavities thus formed.

Fifth. The building up of an inlay in such matrix and baking same.

Sixth. The setting of the inlay into the tooth with cement.

In the first stage he would learn to mix porcelain and mold a tooth—at first in one color; later he would learn to shade the tooth by using two or more colors of porcelain.

In the second stage he would trim the tooth, removing any burr, etc., and if so instructed by his teacher, alter the form of the tooth by adding to or taking from, in this way acquiring skill in carving and the treatment of porcelain generally; and as the material may be used over and over again, no expense on account of waste is incurred.

He would then cut the cavity on lines laid down and described either on blackboard or shown by plaster models, proceeding from simple to compound cavities as he became more expert with the work.

In the third stage he would learn the baking of porcelain, first in baking the whole tooth, and later the inlay of smaller bulk.

In the fourth stage he would learn how to burnish a platina matrix into the cavity. He might also at this stage be taught the method of cement impression and swaging the matrix, thus applying both systems in the one cavity.

In the fifth stage the building up of the inlay with body by stages and baking, then returning to the cavity for burnishing if desired, thus learning in a practical way, and where observation may be accurately made, the actual amount of shrinkage or warpage of the matrix (if any), which takes place in baking, when the body is properly applied.

In the sixth stage the setting of the inlay with cement would be studied, first as to the space actually occupied by cement; second, the effect of different colored cements upon inlays of the same color. For this second purpose, ordinary color paints (which will wash out) might be used of different shades, and when dry, the inlays placed in position without cement, and the color effect tested. This procedure opens up a wide field for investigation, involving, as it does, the "shadow problem" so called.

And finally the tooth or teeth made by the student with the accepted cavities and inlays could be retained by the college for its technic exhibition. The mold, etc., purchased by the student, he would, doubtless, be glad of later, to utilize in making teeth with differently shaped cavities to explain to his patients such points in the work as he might think desirable.

REQUISITES.

1 brass mold in two parts.
1 metal tooth for producing the lingual surface of the tooth.
1 mixing saucer.
1 spatula for mixing.
1 carving tool.
1 bottle of porcelain.
1 packet ground silica.
1 baked clay tray, in card box.

Although this little set of instruments is quite primitive, yet it is sufficient to get the student started in porcelain work. The price of the set is $1.25. Your committee takes great pleasure in recommending this aid to teaching.

At our last meeting we had shown us molds of teeth placed in a vulcanized base which were very much admired. The teeth were perfect in shape and the roots were exposed, showing very good specimens. Now Dr. Arthur has reproduced the whole thing in celluloid, affording a splendid apparatus upon which to do all kinds of work, such as the shaping of cavities, etc. The price of the appliance is $2. Your committee also recommend this apparatus for use in teaching in dental schools.

On motion Mr. Brewster was given the privilege of the floor for five minutes.

MR. ROBERT BREWSTER:

It occurred to me that a set such as this might be useful because of the difficulties which beginners usually experience in the manipulation of porcelain. You will notice that the teeth in this set are of considerable bulk, which facilitates their handling by the student. Cavities can be cut in them in any direction and in any part of the tooth. Any kind of operative work can be done on these teeth and the student can learn something in a tangible way without any material cost. Besides it will teach the student how to build up porcelain and how to bake it. The student can learn to shape the porcelain into any kind of tooth desired by the teacher and do such other work as may be necessary. I prepared this set in order to submit it to you for your consideration.

Dr. Arthur being given the privilege of the floor, spoke as follows:

When I first prepared this model I had in mind using it for operative technique. We all know that while the rubber forms serve a good purpose, yet they do not give the highest conception to the student, and in teaching we have to hold up a high conception as we are very apt to give wrong impressions even when using a diagram. Students will follow an irregularity of that kind much more readily than they will any correct ideas we may give them. The old forms are exceedingly crude, in fact the only thing that can be done with them is to carve out teeth and get an outline of the tooth. I think that I have in this form something that is nearly perfect. In my original carving of the teeth I endeavored to make a composite tooth, something more perfect than we find in the mouth. The teeth in the mouth are rarely perfect; they are either deformed, or they have a cavity or an abrasion of the incisal edge. In operative technics they cannot operate on the teeth because they are too brittle. Here they have a tooth with a perfect contour. They can prepare a perfect cavity and put in a filling as it should be. It gives them something of which they can have a high conception, something ideal. The form is also very valuable to me in teaching anatomy. I have given this apparatus the name of "typodont." Students can also make their carvings from these teeth and they have a high type of tooth.

Again this is exceedingly valuable to me in practice. You can show your patients just what you mean and much better than you can describe it.

The apparatus is an incentive to the student to produce something better than he usually does because he has here all the exact details of a tooth. I do not expect this to cover the whole field; only the technique work.

These appliances were discussed and favorably commented upon by Drs. Goslee and Cigrand.

At this juncture the discussion on Dr. Price's paper was continued by Dr. Logan and closed by Dr. Price.

On motion of Dr. Stubblefield the society extended a vote of thanks to Dr. Black for his very able paper.

The next business in order was the election of officers for the ensuing year. An informal ballot was first taken, and on motion the following were declared elected for the various offices as named:

President—J. D. Patterson, Kansas City.

Vice-President—H. B. Tileston, Louisville, Ky.

Secretary and Treasurer—W. Earl Willmott, Toronto, Can.

Member of Executive Board (3-year term)—R. H. Nones, Philadelphia, Pa.

On motion of Dr. Barrett, Mr. Treat, the representative of the Buffalo Merchants Exchange, was given the privilege of the floor. Mr. Treat invited the institute, in a few well-chosen words, to hold their next meeting in Buffalo. He also presented a written invitation from the mayor of Buffalo. Drs. Barrett and Sherwood warmly seconded the invitation. The invitation was referred to the Executive Board.

Adjourned until 3 p. m.

AFTERNOON SESSION.

The president called the meeting to order at 3 p. m.

The Symposium on the Management of Teaching by Demonstrators in the infirmary was opened by Dr. S. H. Guilford, of Philadelphia. Papers on this subject were sent in by the following: Drs. J. B. Willmott, Toronto, Can.; Dr. J. J. Sarrazin, New Orleans, La. The symposium was closed with a paper by Dr. W. P. Dickinson, of Minneapolis, Minn. The general discussion was participated in by Drs. A. O. Hunt, J. Q. Byram, C. N. Johnson, G. W. Dittmar, H. L. Ambler, G. V. Black, H. A. Smith, N. S. Hoff, H. L. Banzhaf, F. H. Berry, W. E. Grant, S. H. Guilford, J. D. Patterson.

On motion the subject was passed.

The master of exhibits, Dr. Cattell, presented his report, which met with much approval.

REPORT OF MASTER OF EXHIBITS.

EXHIBIT OF TEACHING MODELS, CHARTS, ETC.

Pittsburg Dental College—Vulcanite Typodont, Operative Models.
Western Reserve University, Dental Dept.—Prosthetic Models.
Milwaukee Medical College, Dental Dept.—Prosthetic Models.
Louisville College of Dentistry—Operative Models, Anatomical Charts.
Philadelphia Dental College—Orthodontia Models.
New York College of Dentistry—Prosthetic Models.
Indiana Dental College—Prosthetic Models (crown and bridge).
University of Buffalo, Dental Dept.—Prosthetic Models and Charts, Cleft Palate Models.
Northwestern University Dental School—Prosthetic Charts.
Chicago College of Dental Surgery—Operative Models, Prosthetic Models.
School of Dentistry, University of Illinois—Prosthetic Charts (crown and bridge).
T. E. Weeks, papier mache models for all departments.

EXHIBIT OF STUDENTS' CLASS WORK.

University of Michigan, Dental Dept.—Operative, Prosthetic.

University of Buffalo, Dental Dept.—Prosthetic, Bacteriology.

Milwaukee Medical College, Dental Dept.—Operative, Prosthetic.

Louisville College of Dentistry—Operative, Prosthetic, Orthodontia.

Chicago College of Dental Surgery—Operative, Prosthetic, Orthodontia, Cleft Palate.

Indiana Dental College—Operative, Prosthetic.

Northwestern University Dental School—Operative, Prosthetic.

Ohio College of Dental Surgery—Operative, Prosthetic, Orthodontia, Cleft Palate.

School of Dentistry, University of Illinois—Operative, Prosthetic, Orthodontia.

The exhibit department this year excelled greatly in the character of its individual pieces. Much more system was shown in the arrangement of the class work done by students. U. of M. still holds the palm for conciseness and systematic order of arrangement. The Chicago College of Dental Surgery had the largest showing of class work.

Nine schools showed class exhibits and eleven schools presented "Methods of Teaching" for study. This department of exhibits should be encouraged. Each school should know what the others are doing in models, charts, etc.

Respectfully submitted,

D. M. Cattell.

Upon motion this report was received and ordered printed in the proceedings.

Dr. Black reported for the Committee on Curriculum and presented two curricula for the prospective four-year course.

REPORT OF COMMITTEE ON CURRICULUM.

Mr. President and Gentlemen:

Your Committee on Curriculum finds it very difficult to make a report that is satisfactory to the committee itself; consequently we have grave doubts of being able in any way to satisfy the association. Indeed, it is our opinion, after a careful study of the subject and a somewhat careful canvass of the opinions of teachers, that it would be unadvisable at the present time to undertake to report a fixed curriculum for the four-year course and recommend it as a curriculum to be adhered to strictly by the schools belonging to this association.

The fact is that during the next year the curriculum for the incoming students need not be materially changed from what it is this year, and possibly for the second year of students who come in next year but little change will be required. This being the case, it would seem quite unnecessary that the curriculum for the four-year course be reported at the present time.

But there is another feature of the case that is so important that it cannot be put aside, and that is the demand that each of the schools publish in their next announcement a curriculum for the four-year course. This demand comes from the fact that students will ask to know what they are going to do in that fourth year that has been added, and a curriculum must be offered them, and also a curriculum that will satisfy. This makes it a necessity that something be done by each school in its next announcement regarding the four-year course. It is not necessary, however, that this curriculum be absolutely followed, for it may be changed each year up to the time the fourth year course is put in action. We have no doubt that experiences gained from the study of the subject which will be had between now and that time will make such changes necessary. This does not prevent us from announcing a course, however, for that fourth year that will satisfy students, and also that will represent practically the facts as we intend them. With this understanding, your committee would report two curriculums, differing somewhat as to the number of subjects introduced, with the view of giving a range of choice, perhaps neither to be pursued rigidly, but that each school in making up its individual curriculum may be guided somewhat by these in the placing of their subjects, taking some, leaving others.

The question of optional courses has been discussed considerably, and it may be well to introduce some optional courses in the curriculum. The objection to optional courses is that it is liable to create classes, each requiring a teacher, and thus multiplying the labor of teaching and the expense of teaching to a degree that would be difficult to supply.

Your committee would recommend to each school to make a substantial addition, either to the subjects taught at present or a substantial addition to the number of hours devoted to the subjects now taught; that each year should have its particular curriculum of studies, and that no year be devoted exclusively to what is called "practical dentistry." The fourth year should have from two to three hours of didactic or laboratory work each day. It is believed by your committee that students will do better in their clinical work, both prosthetic and operative, if this time is carefully devoted to teaching along some of the lines that will interest the student in the work he is following in the clinical room. This should have a bearing either directly or collaterally upon that work. More might be introduced in the fourth year that is more strictly educational in its qualities and character than has been done in our three years' course, and it seems to your committee desirable that this be done.

(Signed), G. V. Black,
N. S. Hoff,
W. H. Whitslar.

SUGGESTIONS FOR SCHEDULE FOR FOUR-YEAR DENTAL COURSE.

FIRST YEAR.

Anatomy—*(a)* Osteology. *(b)* Dissecting half of the median half of the human body. *(c)* Recitations.

Physiology—*(a)* Cellular physiology. *(b)* Digestion and nutrition—Involuntary muscular system. *(c)* Glandular system. *(d)* Lymphatic system. *(e)* Vascular system, the blood and circulation. *(f)* Voluntary muscular system.

Histology—*(a)* Unicellular algae, multicellular algae, unicellular animals. *(b)* Elementary tissues; epithelium, connective tissue, fatty tissue. (*c*) Organs; alimentary tract and glands. (*d*) Lymphatics. (*e*) The blood, arteries, veins, etc. (*f*) Voluntary muscles and heart.

CHEMISTRY—(*a*) Inorganic chemistry and chemical physics. (*b*) Analysis of unknown compounds. (*c*) Simpler forms of quantitative analysis.

ANATOMY—Of the human teeth.

OPERATIVE TECHNICS.

PROSTHETIC TECHNICS.

SECOND YEAR.

ANATOMY—(*a*) Dissection of one-half of the median half of the human body. (*b*) Recitations.

PHYSIOLOGY—(*a*) Function of nerves, spinal cord, brain, etc. (*b*) The sympathetic system. (*c*) The senses. Reproduction.

HISTOLOGY—(*a*) Nerves, spinal cord, brain, etc. (*b*) Organs of sense and reproduction. (*c*) Section making of the hard and mixed tissues. (*d*) Bone and periosteum. (*e*) Enamel, cement, dentine. Special studies of the enamel with reference to the formation of walls and margins of cavities. (*f*) Peridental membranes and bony supports of the teeth, gingivae, gums and mucous membranes of the mouth.

COMPARATIVE DENTAL ANATOMY.

EMBRYOLOGY.

CHEMISTRY—(*a*) Study of the metals, refining and assaying, problems in applied chemistry of the metals, alloys and practical alloy making, solders and the chemistry of soldering, care of and the cleaning of mixed scrap, recovery of gold, platinum, silver, etc., from unknown mixtures. (*b*) Organic chemistry.

OPERATIVE DENTISTRY—(*a*) Technical procedures in operative dentistry. Lectures. (*b*) Clinical practice.

PROSTHETIC DENTISTRY—(*a*) Prosthetic technics. (*b*) Clinical practice and lectures.

THIRD YEAR.

MATERIA MEDICA—Lectures.

GENERAL PATHOLOGY—Lectures and laboratory.

Oral Surgery—Surgical anatomy, surgical operations on the cadaver.

Special Pathology and Therapeutics—Lectures. Practice in treatment cases.

Review of Technical Procedures in operative dentistry. Quiz and recitations.

Pathology of the Hard tissues of the teeth.

Operative Dentistry—Lectures. Clinical practice.

Bacteriology—Lectures and laboratory.

Prosthetic Dentistry—Technics. Lectures. Clinical practice.

FOURTH YEAR.

Operative Clinical Practice—Lectures. Management of cases in practice.

Prosthetic Practice—Lectures. Management of cases in practice.

Physical Diagnosis—Lectures and laboratory.

Oral Surgery—Lectures. Clinics. Care of surgical cases.

Applied Physics—Some lectures, but principally laboratory work.

Orthodontia—Lectures and practice. Care of orthodontia cases.

Dental Literature—Methods of post-graduate study.

Ethics, Jurisprudence, business forms, business management of practice, record keeping and dental bookkeeping.

TENTATIVE CURRICULUM.

FIRST YEAR.

Chemistry—(*a*) General Inorganic. (*b*) Qualitative. (*c*) Metallurgy.

Anatomy—(*a*) Osteology. (*b*) General Description. (*c*) Dissection.

Technics—(*a*) Prosthetic Technics. (*b*) Modeling, carving and drawing.

SECOND YEAR.

CHEMISTRY—Organic Compounds.

ANATOMY—(*a*) Embryology. (*b*) Histology, lectures and laboratory. (*c*) Comparative dental.

PHYSIOLOGY—(*a*) Lectures and optional laboratory course in General Physiology. (*b*) Physiological chemistry (optional) lectures and laboratory.

BACTERIOLOGY—(*a*) Lectures. (*b*) Laboratory.

TECHNICS—(*a*) Crown and Bridge Work. (*b*) Operative Technics.

THIRD YEAR.

OPERATIVE DENTISTRY—(*a*) Lectures. (*b*) Clinic.

PROSTHETIC DENTISTRY—(*a*) Lectures. (*b*) Clinic.

DENTAL MEDICINE—(*a*) Materia Medica. (*b*) Pathology. (*c*) Therapeutics.

ORTHODONTIA—(*a*) Lectures. (*b*) Clinic.

FOURTH YEAR.

OPERATIVE DENTISTRY—(*a*) Advanced work in Laboratory and clinical research. (*b*) Therapeutic Researches.

PROSTHETIC DENTISTRY—(*a*) Cleft palate work. (*b*) Porcelain, inlay, crown, bridge and plate work. (*c*) Orthodontia clinics and research.

ORAL SURGERY—(*a*) Physical Diagnosis. (*b*) Pathology. (*c*) Anaesthetics. (*d*) Principles of Practice. (*e*) Therapeutics.

PHYSICS—(*a*) Lecture course in General Physics. (*b*) Laboratory course of Applied Physics. (*c*) Electro Therapeutics.

PRINCIPLES OF PRACTICE—(*a*) History and Literature. (*b*) Ethical Principles and jurisprudence. (*c*) Business forms.

On motion Dr. A. O. Hunt, the secretary was instructed to have copies printed of this report and sent to the various schools having membership in this association at the earliest possible date.

At the suggestion of Dr. Willmott the secretary was authorized to send all copies of past proceedings to Dr. N. S. Hoff, who stated that he had files in his possession and would supply copies to those applying for them.

At this juncture Dr. Ambler inquired whether the committee on nomenclature of the National Association had adopted any name in preference to another for the dental clinic room. Whether this should be known as the infirmary, the dental hospital or the operatory.

Dr. Brophy moved that it be the sense of this body that the term Dental Infirmary be employed to designate the place where the students fill teeth and do other clinical dental work. The motion was carried.

Dr. Stubblefield moved that a vote of thanks be extended to the profession of Chicago for the excellent way in which they entertained the visiting dentists.

Motion carried.

Dr. Hoff moved that a vote of thanks be extended to the proprietors of the hotel for the many courtesies shown the association.

Carried unanimously.

Dr. Brophy then presented the newly elected officers, who were duly installed.

The newly elected officers expressed their appreciation of the honor conferred upon them. Dr. Willmott particularly thanked Dr. Goslee for the invaluable assistance which he had given him in the carrying out of the work of the Executive Board.

On motion of Dr. Smith the retiring officers were given a rising vote of thanks for their efficient work.

After the reading of the minutes of this and the preceding session, the institute adjourned sine die at 5:20 p. m.

PRESIDENT'S ADDRESS.

By Hart J. Goslee, D. D. S., Chicago, Ill.

An earnest and just appreciation of the duty devolving upon me, as your presiding officer, of presenting an address at this time, causes me to assume the task with a modest degree of temerity.

Being keenly mindful of the purpose and character of this gathering, I fully realize that I am to address the contingent of the dental profession upon which rests much of the responsibility for our professional advancement through the institution and prosecution of means for raising and supporting its more progressive educational methods; and those to whom, I believe, the profession must now look for the establishment and maintenance of wise and correct fundamental, basic principles of education.

It is this realization, combined with the knowledge that I am expected to follow the custom of my official predecessors in naming and intelligently treating the subjects which most pressingly interest us, and demand our consideration, that makes a task and a pleasant duty appear to me to be somewhat analogous.

My conception of this responsibility so completely overwhelms me that should I be able to even approach a just and rightful performance of the duty I shall certainly outdo my most sanguine expectations.

We meet to-day in a convention which is made auspicious by marking the tenth milestone in our history—our tenth anniversary. While we have but to look backward over our vigorous record, and upon the work we have accomplished, to prove the efficacy and usefulness of our organization, such a retrospective view of that which has been already performed, and of the benefits which have accrued therefrom, only enables us to more clearly grasp, and to more fully appreciate, the fact that at the end of the first decade even a greater and broader field for bettering the work of dental education now lies before us.

It has been the good fortune of this body to enjoy a marvelously rapid growth, and to assume a sphere of usefulness beyond controversy, but the premises which we now occupy by virtue of predestination, perhaps, augmented by health and vigor and energy, should not allow us to become unmindful of the primitive efforts which have made it possible to attain to the achievement of results which have in turn aided so materially in the progress of dental education. These efforts, I believe, warrant me upon this occasion in indulging in a brief reference to our history and progress.

Organized for the purpose of fostering and advancing the methods of teaching the technique pertaining to the art and mechanics of dentistry in our schools, a line of work was inaugurated which was new, which was needful, and which awaited and offered great opportunities for development.

From a small coterie dominated by enthusiasm in their special field of work, and imbued with the belief that ways and means by which an interchange of ideas, and a dissemination of thoughts along the line of the teaching of that class of work which was of a purely technical nature should be permanently established, and would be productive of much general good, we have grown until we now encompass a broader field, and one more scientific and strictly pedagogic in character.

When an organization is born it is not always possible to prophesy the scope of its life's work. In the midst of a primeval forest we have hewn, cleared, builded, added to and embellished until there now stands a structural work of sturdy proportions, and of modern scientific architecture.

Whatever the original thoughts and the primary objects might have been, the tendencies of this organization from the very first have been to enlarge the range of subjects to be considered. While this disposition was for a time questionable in the minds of some, it ultimately became warrantable, and apparently necessary, for the reason that no other body assumed to devote the proper attention to this particular line of work, or seemed so well adapted to such purposes. As a result, our present status is but the natural outgrowth of necessity, and any institution must be a needful acquisition to its immediate community to succeed and advance.

While it is notably true that advancement along the lines of teaching is being constantly made in every department of educational work, this advancement is perhaps more particularly evidenced in dentistry than in any of the arts and sciences; unless it be the science of pedagogy itself, which is still in its infancy.

That the work and influence of this Institute have done much to inspire and promote this degree of development and progress can scarcely be doubted.

During our past meetings we, as teachers, have been getting closer and closer together. We meet as men engaged in the same lines of work. Our interests are mutual. We have no legislation or politics to engross or divert our attention. We know how the various teachers in different schools present and teach their respective subjects, and we are more or less familiar with the advanced ideas of the most successful teachers.

The natural result of such coordination is that a more advanced, progressive and uniform course of instruction is now given in all of the fifty-two recognized dental colleges in the United States and Canada, in view of which, since no other body has been similarly engaged, or could devote their concentrated efforts to such work, it seems quite improbable for this Institute to have infringed upon the territory, or usurped the rights of other organizations.

The development of system in the methods of teaching during the past decade, and the constant improvement which is being made along these lines, all of which are evidenced by the amount of instruction now being given in a course of three terms, as compared with only a few years ago, must be regarded as an eloquent tribute to the work of this body.

When we pause and reflect upon the vast amount of instruction which the well-regulated dental school now succeeds in giving during the prescribed course, and the part which this organization has played in making it possible, and in further developing and promoting it, both the degree of correctness in our principles and purposes, and the scope of our possibilities and usefulness are manifest, in view of which I submit, without fear of just criticism, that the whole range of dental teaching is not too broad to be considered by this body, or to be benefited by its deliberations.

The subject of dental education in the broadest sense, in my opinion, is now by right of privilege and competency the work of this institute. With such interpretation of our function, it would seemingly be quite inadvisable, if not, indeed, impossible, to draw any line of distinction between the teaching of all correlative subjects which must be included in the dental curriculum, and which result in the further development, progress and broadening of our educational requirements.

Because of the indomitable activity pervading the ranks of this body, and the nature of our contributions, which have encompassed a range extending from the purely practical to the highly scientific, thus enabling us to become rich in experience, I believe that in so far as *the prerequisites of teaching* are concerned, this is now the one organization in America perhaps best qualified and most competent to consider *all* questions and problems pertaining to the advancement of dental education, and that an infinite amount of general good must necessarily result from such consideration.

While we have no legislative power—and I trust that we shall never assume to have, for much of the good work which has been accomplished may be attributed directly to this fact—I am of the opinion that it is also within our special province to include and deliberate upon the subject of curriculum.

This is said advisedly, because I entertain the belief that nothing has more to do with modern dental education than a well regulated curriculum, and I am also constrained to affirm that much of the advancement which has resulted, directly or indirectly, from the efforts of this body, or which shall so result in the future, may be attributed to the systematizing and unifying of the curriculum, as well as to the development and elaboration of teaching methods.

However much progress has been made in recent years in the systematic presentation of principles, the teaching of dentistry has not yet quite crystallized into permanent form, and the work incident to such crystallization, and to properly placing these principles in the curriculum, may yet require some time, and is just now of infinite and paramount importance.

In all branches of general scholastic training, there is a universal lack of unity, and while a more or less uniform dental curriculum would doubtless be eminently desirable, the individual conditions and environments are such that any effort to establish the same would probably prove futile. It may not even be possible, or to the best interests of the individual schools, yet, at the present time, there is such a wide diversity that the condition is almost deplorable, and there can be no doubt but that a far greater degree of uniformity would be of inestimable advantage to all colleges, and to the progress of dental education.

As to what should be the possible scope of an adequate and suitable curriculum, I could make no better or broader recommendation on this, the very eve of the adoption of the four-year course, than to quote from the splendid address of my immediate predecessor, Dr. George E. Hunt: "The dental college curriculum should be such that a degree of Doctor of Dental Surgery will carry with it a breadth of knowledge, and a wealth of attainment, that would put its possessor on a plane with those who have taken the degree of Doctor of Medicine."

That this is a laudable and reasonably logical recommendation must be admitted, and that it is without doubt the desire and effort of the representative colleges and teachers to so qualify their graduates is evidenced by the increased course of preparation and study now required by all reputable dental schools.

In view of the marked development and advancement in this connection, there is seemingly but one essential prerequisite to such a sequence, and this is that the preliminary requirements for admission into all dental schools must first be placed upon a more or less uniform standard similar to that governing admission into the leading medical schools. In this connection, I believe that an educational qualification for admission into our schools should be equivalent to that for the admission of students into all high-class institutions of professional learning.

This, however, is the work of our legislative bodies, and is now being more or less diligently prosecuted, to the end that when this shall have reached an equivalent standard, it is safe to prophesy that graduates of dentistry will be received and recognized on the same plane with those from the school of medicine. Moreover, they will be sufficiently well qualified to justly merit and sustain such recognition.

Indeed, even at the present time, with much work, and an evergrowing opportunity for improvement still before us, as an evidence of our progress and as a result of the increased requirements incident to pursuing the study of dentistry, of the development and systematizing of our methods of teaching, and of the broadening of our curriculum to its present scope, I feel sufficiently well informed by observation and comparison to agree with the statement recently made by Dr. Truman W. Brophy, in his address to the Commission on Education, International Dental Federation, at Stockholm, Sweden, to the effect, "that the average dental student in the representative dental colleges of America today has to cover a broader field of preparatory work than the average medical student under similar environments, and that the average graduate of such a dental college is, on the whole, better qualified to undertake the responsibilities incumbent upon the practice of his profession, than is the average graduate of such a medical college."

This statement may possibly seem somewhat dogmatic, but if we contemplate the full preparatory course of the dental student, and that the most successful and proficient practitioners are those who early adopt, and confine their efforts to, a particular line of work or specialty; that the study of dentistry is infinitely the study of a specialty, while that of medicine is of necessity more general, I believe that a surprising degree of truthfulness and correctness will be revealed. Because of the high degree of manipulative skill, and of the knowledge of the intricacies and technology of art and mechanics demanded by the specialty of dentistry, I regard it as entitled to rank next in importance to the specialty of *general surgery*, which is the manipulative and mechanical department of medicine.

The efforts of this organization stand out conspicuously among those of others in the development of conditions which thus place the specialty of dentistry on a higher plane, and tincture such utterances with reason and logic. Dentistry has assumed the dignity of a profession, and the practitioner that of a professional man, simply because of the tendency toward higher educational requirements. Even in the most humble community, a professional man is accorded a certain degree of respect, not because of his personality, or of his efforts to exemplify the modern Beau Brummel, but solely for the reason that the title carries with it a certain assurance of the pursuit of learning and the acquirement of knowledge which is somewhat beyond the strata of commercial pursuits.

But, as a body, we can yet do more. If we are to contend for regard as embracing relationship and equality with higher medical science, we must further extend our curriculum to include all necessary and useful correlative subjects.

Incident to the installation of the four-year course, I regard nothing of such momentous importance as the consideration of the various changes in, and additions to, the curriculum, which must necessarily be made to broaden the course and cover the extended time to the very best advantage. And, while not unmindful of the preceding excellent recommendations in this connection, and of the appointment of a special committee which is expected to report at this meeting, I am, nevertheless, constrained to briefly indulge in a few recommendations on my own account.

Among other advanced ideas, our profession has come to regard with interest the importance of the subject of physical diagnosis. Some colleges have already added this line of study to their curriculum, and others are putting forth some effort to establish it in theirs.

This effort is most heartily commended. I believe that the dentist's province of labor demands a knowledge of the varied physical conditions constantly met in practice, notwithstanding the somewhat cynical opinions occasionally expressed by more or less narrow-minded members of the medical profession to the contrary.

It has been intimated that the only occasion for knowledge in physical diagnosis on the part of the practitioner of dentistry is in connection with anesthesia, and while we might concede that this connection is the most important one, yet I deny most emphatically that it constitutes the entire scope of desirability and requirement for knowledge of the physical conditions presenting.

Knowing that there is a relationship existing between the dental organs and the general physical condition, even though this relationship is largely of an indirect nature, should we ignore the study of the manifestations of these conditions?

I believe this study should be pursued with as much interest and energy by the student of dentistry as by the student of medicine. I entertain this opinion, not only because of the importance to the dentist of knowledge of this science, but because I cannot countenance restriction of dissemination of knowledge to the dental student which will even indirectly aid him in better fulfilling the purposes of his calling, or which shall detract from his standing before the community as an equal in scientific aspirations and attainments of the student of medicine, or of any other science or profession.

A dental course in this subject to be sufficiently broad should embrace didactic instruction in the normal location of the thoracic and abdominal organs; the location of pathological conditions, and the diseases which may cause them; the effects produced by these pathological conditions upon the general system, and how such may indirectly cause diseases of the teeth and mouth; the care of the teeth during, and precautions incident to pregnancy; the care of the teeth and mouth in syphilitic conditions; the deformities of the teeth and mouth which may result from naso-pharyngeal conditions; the indications for general anesthesia, and the precautions and dangers incident to its use.

This didactic work should then be supplemented by a practical course, consisting in the examination of the normal and abnormal chest; the diagnosis of pathological conditions of same; and the examination of the heart, lungs, kidneys and liver, together with the effects produced upon these organs by the administration of ether, chloroform, nitrous-oxide and cocaine, or therapeutic agents of any nature which might have a pathological influence upon them, bearing upon anesthetic administration. All of these considerations from a general point of view are important, and from a dental view-point are essential to a broad education.

I also heartily endorse the previous recommendations for a thorough and well-rounded course, from a dental view-point, in biology, bacteriology and applied physics, the importance of each of which demands for them a more or less conspicuous place in the curriculum, as a means of further broadening the desired preparation and qualification of the student.

A course in pathological laboratory work would also be a valuable addition. The student would thus be enabled to examine into the varied pathological conditions constantly met in the infirmary, and be the better prepared to successfully treat such conditions because of the possession of knowledge of means for facilitating the accuracy of scientific diagnosis.

A practical laboratory course in pharmacy, materia medica and therapeutics is also recommended, and without doubt would prove of inestimable value.

I would suggest that such a course be divided into separate classification, as designated, and that each should embrace the following:

Pharmacy. First: Metrology. Weights and measures; the metric system; specific gravity, and use of apparatus for determining same of both solids and liquids; specific volume; parts by weight; percentage volume and weight; percentage solutions.

While this is, of course, almost exclusively *physics,* its direct bearing upon the completeness of such a course warrants its place in this classification, and a more advanced didactic and laboratory course in applied physics, to include fundamental instruction in the possibilities of electricity, photography, radiography, etc., would also be useful and eminently desirable, and without which the curriculum of any dental school will be incomplete.

Second: *Pharmaceutical Preparations.* All such preparations need not, of course, be considered, the selection being confined only to those *classes* which are, or should be, used in dentistry, e. g.,

a. *Solutions.* Those solutions, under which general class belong such preparations as waters, solution, spirits, syrups, elixirs, glycerites, collodion, etc.

b. *Products by Extraction.* Wines, vinegars, tinctures, fluid extracts, extracts, etc.

c. *Mixtures.* Liniments, etc.

d. *Mixtures of Solids.* Powders, etc.

e. *Preparations for External Use.* Ointments, plasters, etc.

Third: *Prescription Writing.* Under this head should be considered (a) language and abbreviation; (b) the signs and terms; (c) incompatibility, etc.

Fourth: *Compounding.* In this work prescriptions should be written calling for both official and unofficial preparations, such as ointments, powders, plasters, percentage solutions, etc.

Such prescriptions should be *corrected* and *filled,* thus imparting to the student a knowledge of the art of mixing ingredients as well as of prescribing.

Materia Medica. The work of materia medica should consist in the study of *crude drugs,* with an examination of the *characteristic* of the drug as it appears in commerce; the official *title* in Latin and English; the *origin,* whether botanical, animal or mineral; their constituents, properties, dose, and the various pharmaceutical preparations into which they enter.

Therapeutics. This work would best be devoted, perhaps, to demonstrations and experiments upon the lower animals, as such is the only effective means of treating practical toxicology. The action of such poisons as arsenic, morphine, cocaine, strychnine, etc., may be observed, and the antidotes for each, and how they may be best administered, can be considered.

Special attention may be also directed to the application of each drug, so studied, to the various pathological conditions of the human system.

A course in *Laboratory Physiology* would also prove a valuable addition to the dental curriculum, and the following suggestions may serve to illustrate the possibilities and practicability of such a course:

I. Electrical Batteries: Elements, conductors, keys, commutators, rheostat, rheocord, etc., and the teaching of the uses of the various apparatus employed in muscle and nerve stimulation.

II. Muscle-nerve Preparation: Stimulation and records; the laws of construction, work done, etc.

III. Circulation: Frog's foot: The laws of flowing liquids; force-pump; pressure; schemes for artificial circulation; pulse sphygmograph; vagus effect, etc.

IV. Respiratory Measurements: Pressure; lung capacity; laws of gases; respiration of various gases; nerve stimulation of respiratory apparatus, etc.

V. Ferments: Action on carbohydrates, proteids and fats; characteristics of foods; laws of absorption; diffusibility, etc.

VI. Blood: Counting corpuscles, hemoglobin determination: hematocrite; bone marrow; blood clotting, etc.

VII. Physiological action of the more common drugs on tissues in which the local effects on flesh, etc., and the constitutional effects on live animals may be observed.

This course may be made supplementary to the former, and each will be benefited by and advantageous to the other.

Getting down to the more practical subjects (so-called), I also earnestly recommend the addition of a thorough *laboratory course* in *dental metallurgy*, based somewhat along the lines recently suggested by Dr. Hodgen, and deprecate the fact that so little attention is given to this important work by so many schools.

The course must necessarily follow a didactic course, and the first work in the laboratory should be to familiarize the student with the various apparatus, appliances and fluxes used in the fusing and alloying of metals.

This should be then followed by a study of the metals, their characteristics and physical properties, and those should be selected for the first experimental work which best illustrate these general properties; and those properties of malleability, ductility, tenacity, conductivity, specific gravity, fusing point, electro-positive character, etc., should be carefully noted.

The experimental study of the individual metals should be followed by mixing them in the preparation of alloys, and *all of the various alloys used in dentistry should be prepared by the class.* In this work the student becomes acquainted with the properties of alloys by discovery. He notes the influence certain metals have on the alloy, and the difficulty of adding low fusing and easily oxidizable metals to higher fusing ones, which is especially important in making solders and dental amalgam alloys, all of which knowledge is so materially essential to their proper and skillful manipulation.

In view of the rapidly increasing importance of the ceramic art in its application to dentistry, I also most urgently advocate a course in advanced operative technics, to embrace the various phases of porcelain work.

Such a course should consist in the study of the composition and characteristics of porcelain "bodies;" their preparation, coloring, shading, manipulation and fusion, and the preparation of cavities and adaptation of inlays by the various methods. In this connection

I am pleased to endorse and call your attention to a simple method of presenting this subject which has been devised by Mr. Robt. Brewster, of Chicago, and which upon request will be further elucidated during this meeting.

Granting that all of these, and perhaps many other additions of equal importance, must be accommodated and properly arranged in the four-year curriculum, I believe that after the first year shall have adjusted itself, we will wonder how we succeeded as well as we did without them, and in less time.

I also believe that the amount of time spent upon the teaching of all subjects, and their proper place in the curriculum, can and should be settled by this body; and that if any degree of uniformity is to be obtained, our efforts will be productive of much good. In this connection, however, irrespective of individual exigencies or conditions, the arrangement must be made on a "broad, sound and logical basis, and not for the convenience of any school or teacher."

In the arrangement, it must be remembered that we expect and exact much of the student, much that is unnatural and difficult, for many; for but a limited proportion are capable of grasping and comprehending the more scientific elements, and assimilating with them those of the more mechanical and technical order.

The first efforts, then, should be directed toward the development of an interest in the work, a recognition of the requirements, and an appreciation of the possibilities. It has been said that in the development of handicraft of an artistic nature, we must first cultivate the sight, as the eye must see in order that the mind may comprehend, and the mind must comprehend before the fingers can execute.

When this stage of development has been reached by an adequately adapted primary course in manual training, such as has been already recommended, and accepted as invaluable, the student is then prepared to more fully appreciate the advantages of technique, which, of course, has for its basic object the development of familiarity with the fundamental principles, and with the nature and characteristics of the materials employed.

For this reason, if the arrangement be based upon a scientific, progressive system, I am of the opinion that prosthetic technics should begin with and extend through the first year, and that the only part of operative technics given during this period should be a thorough groundwork in dental anatomy; and the present system of carving is regarded as the best means of impressing the latter subject.

As a further evidence of the logic of this recommendation, I will quote a statement made several years ago by Dr. N. S. Hoff, with which I am in perfect accord: "One of the strongest reasons for making the prosthetic course the primary and fundamental one is because of its being so versatile—some of the operations being so simple and others so intricate that it is admirably adapted to the purpose of developing skill in handicraft." For this reason, the student who has pursued this course first, and has also received instruction in dental anatomy, is thus better qualified to take up operative technics at the beginning of the Sophomore year, which, in my opinion, is where it properly belongs, and should be placed.

In conclusion, gentlemen, permit me to take occasion to express assurances of my deep sense of appreciation of the honor you have conferred upon me, which thus permits me to inflict myself upon you in this humble plea for increased and broader educational and professional requirements, and to thank all of the officers for their loyal support, and you for your attention.

DISCUSSION.

DR. N. S. HOFF, Ann Arbor, Michigan:

Mr. President, it gives me great pleasure to commend the very admirable and suggestive address to which we have just listened. I am particularly pleased because Dr. Goslee selected as his theme the ever-interesting subject of the curriculum. This selection is especially fortunate in view of the fact that the committee which was to have made a report at this time upon the character of the curriculum for the four-year course is unable to make that report. An opportunity is afforded us to discuss this important matter by taking up the various points considered by our President. As a member of the committee appointed by the National Dental Faculties Association to prepare a four years' curriculum, I prepared one which I thought might at least serve for the purpose of eliciting discussion; but when the committee had its preliminary meeting at Niagara Falls, last summer, it was decided that it was not an opportune time to enter into a discussion of that subject. The committee concluded that it would simply hand in a report of the curriculum committee and allow it to be printed in the transactions, to lie over for a year so that the members of the association might have sufficient time to think the matter over.

I have been cherishing the hope that your committee on curriculum would bring this subject up for discussion at this meeting, because I am convinced that in this body we can more deliberately discuss this subject than would be possible in the National Dental Faculties Association. Here we have less of outside interest. I trust we may be allowed to discuss it fully in connection with the President's address. Before another meeting of the National Faculties Association is held the announcement of the four years' course must be published by every dental college in the country, and that announcement should contain a four years' curriculum.

The suggestion made by the President of the desirability of a uniform curriculum for all the schools must appeal to us as a timely one. It declares the object to which we have aspired in the discussions of this body for the last ten years. We have been working toward it, yet we have not been able, either theoretically or practically, to come to any definite conclusion. But our minds are gradually centering toward uniform methods of instruction. This has come to be so not because we wanted it, but because by exchange of ideas each one has been compelled to modify the consideration of his special subject. Each teacher has seen in the methods of another things which he could adopt with benefit.

I do not think that it will ever be possible for us to dogmatize on this subject. We may gradually drift into a practically uniform curriculum because of this interchange of ideas which occurs in these meetings, but there are many difficulties to meet. Every school has its own environments and peculiar features, something which we cannot possibly control as a body, because each school must solve that problem for itself. Hence I do not expect that we will ever arrive at an absolutely uniform course of study for our dental schools.

But we may well let that take care of itself. So long as we continue to come together year after year to discuss subjects I have not the slightest doubt that our curriculum will in due time be sufficiently uniform for all needed purposes.

The most important question at this time in connection with this subject is the consideration of what shall be done with the added year of instruction which goes into effect this fall. What shall this instruction be? I am not prepared to answer that for anyone else, but I have my own views about it. Through the influence of this association and other instrumentalities, to which I have already referred, we are progressing along the lines of technical development in a way that is entirely satisfactory. That department of our work should be disturbed as little as possible. The first three years should remain practically as they are now. They should contain practically the same subjects, taken up in practically the same order and to the same extent. In this way we will gradually work into the four years' course in the easiest possible way and without disturbing existing conditions, and there will be less occasion for making mistakes. If we attempt to reorganize our whole system of instruction and adopt some ideal scheme based on four years of instruction, tearing to pieces our present curriculum, I fear that the results may be very unsatisfactory. I think that in the first three years of our present curriculum it is possible to develop the technical aspect of the subject sufficiently for all practical purposes. But it seems to me that we should make a more general advance. There is a great deal said about our being a profession, but we are often compared with others to our disadvantage. We are called techniquers and mechanics and we have no broader outlook than any other mechanic in a high grade department. That is, of course, mere talk with which we cannot have any sympathy, because it is not founded on truth. But there is apparently some reason for it because of the fact that the large majority of the members of the dental profession today are men who have not gone much farther than the technical departments. Occasionally you will find a man who branches out into literature or other subjects and makes a name for himself. We have a few specialists, a few scientists, a few Blacks and Millers, who have gone on in advance of their profession, but the rank and file have not advanced very much. It seems to me that the reason in large part has been that we have not in our system of education taken cognizance of the principles that are necessary to develop that sort of men. The students do not have any opportunity to think for themselves. Their time has been occupied with technique and their minds filled so full of the practical side of their work that they could not take advantage of the opportunities which presented for the development of the scientific side and of a broader culture.

In this fourth year of our course we ought to take up the scientific subjects and study them in such a way as to develop men who are able to initiate for themselves work of a scientific character. Preferably it ought to be in the line of such subjects as pertain to dentistry. How many men are there in the dental profession today who have any fundamental knowledge of the subject of physics? We must confess that we know very little about it. There is hardly a man practicing dentistry in Chicago but who is making more or less use of electricity, but when his machine gets out of order he must send for an electrician. He cannot put in a fuse, nor make other necessary repairs to his engine. He knows little or nothing about the management of that wonderful agent. The whole subject of cataphoresis has gone out of existence because we did not know how to use it. The subject of radiography is also one that is beginning to come into notice, and as dentists we have greater opportunities for developing the practical application of electricity than any other profession. There is hardly a dentist anywhere who is not using electricity in some form or other. Among physicians you will find one here and there using electricity, but they are few when compared with the number of dentists using it. And why should we not know all about it? That is one subject which we might add to our four-year course. There is enough in it to take up the time of the whole year.

Another subject is the introduction into this fourth year of original research work. Is it not possible for us to lay the foundation so broadly that in the future, instead of having only one or two men in the country doing this work, we may have many of them?

In this way our profession will make the advance that is demanded of it in order that it may be recognized as a profession by everybody.

There is, then, no question but that there is an abundance of new material which may be utilized in the fourth year without disturbing the present curriculum in the least.

Dr. S. H. Guilford, Philadelphia, Pa.:

I did not have the pleasure of hearing the whole of the President's address, and therefore what I have to say will be more on what Dr. Hoff has said. I have two thoughts to present. One with reference to the four years' course. He gave it as his opinion that the college course as it exists at the present time should be the course which is followed in the four-year course, and that the fourth year should be devoted largely to practical work. That would be very well were it not for the fact that most of the final examinations come at the close of the fourth year; and also because of the fact that the state board of examiners insist on examining all the students on all the subjects at the close of their college work.

Now, if a student is examined at the end of the fourth year on work that he completed in his third year he will hardly be prepared to stand an examination at the end of his college course. For this reason I do not believe that Dr. Hoff's idea is a practical one.

There is another solution of that question, however, one that struck me rather forcibly. Many of you no doubt know that in the State of New York the medical examining board has arranged that the medical student shall be examined at the end of the second year on the studies pursued during the first and second years, and, if passed, that examination is final so far as those studies are concerned. At the end of the fourth year students are examined on the studies pursued during the third and fourth years. That method is both equitable and just, but unfortunately we have no such procedure in our dental work. That matter was strongly emphasized by Dr. Litch in an editorial appearing in the *Dental Brief*, in which he called attention to this fact, arguing that the Dental Examining Boards of the various states should arrange that when the four years' course begins students will be examined twice during their college career; first at the end of their second year on all work done during the first and second years, and at the end of the fourth year on all work done during the last two years, so that the student will not be compelled to be examined on subjects on which he naturally has become rusty.

Unless we can make some such arrangement it would not be advisable to stop theoretical studies at the end of the third year or to pass any final examinations at the end of the third year. I hope that this subject will be considered fully by all interested with the view of prevailing upon the Dental Examining Boards to give the dental student two examinations; one at the end of the second year and the other at the end of the fourth.

The second point I wish to refer to is with regard to the matter of physics, teaching physics more fully in the dental schools: I agree thoroughly with Dr. Hoff; I realize how imperfectly the subject has been taught in the past and I also realize the importance of it. Dr. Hoff referred especially to a particular branch of physics, electricity. I do not feel the importance of that so much as I do of others. In my opinion the most important part of physics is dynamics. There we come in contact with things we use every day, such as the laws governing force. How can a man make a plate and have it give proper service unless he knows something about how the force will be exerted to hold it in place in the mouth, and know the force that will give the best use of the plate? I have known many a plate to be a failure because when the mouth is closed the teeth meet in the wrong direction; instead of pressing upward and backward they press upward and forward.

And so it is with everything connected with artificial work that we have to do, not only as to modifications in the forms of the teeth but also in the way in which force is to be applied to different mechanical appliances. If we can get the student to understand the principles governing these things we will have conferred upon him a wonderful benefit. The whole subject is a large one; we are nibbling at it here and there, and I have no doubt that out of this discussion we will derive some good. But we must be careful in considering this matter so that we may approach the subject in its entirety and select from the whole matter such things as we think are of the greatest importance.

DR. E. T. DARBY, Philadelphia, Pa.:

I regret that owing to a belated train I did not hear the first part of the President's address. What I did hear, however, impressed me as being able and comprehensive in character. I have also listened with much pleasure to Dr. Hoff in his discussion. They have both outlined a curriculum which, if it could be carried out, would thoroughly equip the dental student to enter upon the practice of his profession, but I am in doubt about so much being accomplished in the time allotted. Broad culture many-sidedness are beautiful things to contemplate, but I greatly fear the tendency has been and still is to add too many things to our dental curriculum. We are striving to make too much beside practical dentists of our students. The tendency is to demand too much of our students at the expense of the practical work in the operative clinic and the prosthetic laboratory. We have already in our three years' course as much as we could reasonably expect a dental course to furnish. The men who have become great have wrought their greatness since leaving college. It has taken more than four years to make a Black, a Barrett, a Miller or a Brophy. All that the colleges can do is to lay the foundation, and if the student is made of the right material he will complete his education in a scientific direction after he has received his diploma. I may surprise you by the statement, but I have the courage to utter it, that I believe we made better practical dentists twenty years ago than we do today. We did it because there was less demand upon the student's time in acquiring a knowledge of chemistry, anatomy, physiology, histology, bacteriology, osteology, etc., etc. The student of today spends more time in learning these things, good as they are, than he does in the operative clinic and the mechanical laboratory.

We are about adding another year to our course, and I would make a plea for a year of practical work. Few men are competent to practice dentistry when they leave college. They lack the skill which practice alone can give them. It is only by doing over and over again the operations which the dentist is called upon to perform that he becomes skillful. All men are not alike apt in learning. One man will accomplish in three years what another will fail to do in four. Let the work of the fourth year be of such a character that the mediocre man can perfect himself in the point where he is weakest and the man who has mastered the curriculum of the three years can do research work in the fourth. It seems to me that the one important thing for us to do is to make good dentists, and although we may succeed in turning out good chemists, good anatomists, good histologists, good bacteriologists, if we do not turn out good practical dentists we are falling short of our duty as teachers.

I beg of you, then, as one who, like yourselves, is interested in college work, make this fourth year which will soon be added to our course largely a year of practice, and, my word for it, we shall graduate men better qualified to practice dentistry.

DR. WM. C. BARRETT, Buffalo, N. Y.:

I am heartily in accord with what the previous speaker said until he reached a certain point, from which I must diverge. That point has reference to the character of the teaching. Four years is certainly none too much for our elementary training. The idea of contracting and condensing all our instruction into three years is an absurdity, when we take into consideration the extraordinary expansion of the curriculum made necessary by the growth of dentistry during the past decade. We have added science to science, and study to study, until the lecture schedule is so congested that scarce time is left for eating and sleeping on the part of the diligent student. I tell you that we cannot do good work in this way. The great trouble with our schools and teaching today is that we are hurried too much. We can do little more than to "cram" students, and you well know that mental indigestion is the natural result of such a process. You are aware that in all schools it is sometimes the case that at the close of the term a bright student who has done little in the class room during the whole term proceeds to "cram" for the examinations, and he may readily be able in this way to pass them successfully. But he has consumed his mental food so fast that there has not been time for perfect assimilation. He has "bolted" wisdom, as some greedy children do their dinners, to the ruin of the digestive apparatus. This kind of either mental or bodily feeding is the worst possible. Under it we are even now working our students too hard. We are not teaching deliberately, calmly, slowly, effectively, piling fact upon fact only so rapidly as the mind of the student can assimilate each and make it a part of his educational structure. When we attempt to give three lectures in one forenoon, each an hour long, perhaps one on anatomy, another on histology and a third on chemistry, one following the other, they become a confused jumble in the mind of the average student; his apprehension and comprehension are overtaxed; his appetite is clogged; his assimilation is obstructed; the principles inculcated remain an undigested mass, if they find lodgment at all. There is no time for reasoning; we cannot *educate* (educo—to draw out); we can only thrust in that of which little use can be made; there is no opportunity to make practical use of that which is imparted. This I maintain is not to educate. It will not make the best practical men. Under it we shall in time degenerate into intellectual prigs who know all of dentistry save its practice.

The proper method of teaching, the teaching which is successful, is that which is done deliberately; giving time enough for the assimilation of the facts, opportunity thoroughly to comprehend them and then to compare them with other related truths. When the student is driven too hard, forced to the extreme point of endurance, there is no perfect education, and there can be none.

I am quite in accord with the previous speaker when he says that we are loading up our curriculum with sciences and subjects which should be placed in the preliminary course. Is a man to enter on the study of applied science without a knowledge of physics; should he go back and learn his a, b, c after he has started on a course of technical training? No, he must have an elementary schooling which he should receive in his preliminary course, and then we can build on that structure, and rear an edifice that shall endure, that shall be harmonious and symmetrical and perfect in all its parts.

Concerning the fourth year which we are about to assume,—I thoroughly believe in the method pursued in New York in the medical schools, that in certain basal studies the students shall be allowed to take their final examinations at the conclusion of the work in those branches, that their last term may not be crowded too much. Not that I would advocate having our students take their final examinations at the end of the second or third year, except in such basal studies as form the foundation for their real professional work. My idea would be at the end of the second or third year to finish and take the final examination, not only in college but at the hands of state dental examining boards, in anatomy, chemistry, physiology, materia-medica, embryology and histology, with possibly one or two other studies, so as to relieve the congestion of the curriculum,—the state dental examining boards, where there are such, should admit to final examination under the proper restrictions, for students must take them when the matter is fresh in their minds. Thus they can devote their fourth year to the applications of that which they have previously learned. I do not mean that I would postpone all practical work until the fourth year. The principles should be applied as fast as they are acquired. I would not make the fourth year a post-graduate course, but I would include in it much that can now be only acquired as post-graduate work. I would devote the fourth year to the higher expressions of prosthetic and operative procedure, and I would in addition give thorough instruction in oral surgery, pathology, therapeutics, diagnosis, biology, etc. After such a course we might hope to see graduates grounded in that of which practitioners of the present day talk a great deal, but of which personally they have no comprehension whatever.

The complete course of study, the general curriculum then should include all necessary branches, and should not close until the final fourth year. Hence, simply to devote the whole fourth year to practical work is robbing the preceding classes of that which might with propriety, some of it at least, be given to them, and at the same time it is depriving the senior or fourth year class of very much of scientific information, of that more advanced knowledge which should form a part of the whole curriculum.

We can only arrive at a wise conclusion by a comparison of ideas and thoughts and methods in the consideration of this subject, and I am thoroughly convinced in my own mind that the fourth year must include a fair proportion of didactic as well as practical instruction. Just what the proportion will be depends upon the instructor, because the really competent teacher will certainly adapt his instruction to his classes. He cannot be taught that; the wise teacher must be a wise man; a man who cultivates his mind; to a certain degree an ascetic, a recluse, who denies himself the luxuries of life and devotes himself entirely to intellectual studies; who is competent properly to disseminate knowledge and to discriminate amongst studies and between students. I say he must to a degree be an austere man, of hermit proclivities. That follows as a matter of course. He cannot avoid seclusion or the mortification of the flesh. If he devotes himself to his extremely rigorous but ill-paid calling, he will have neither time nor money for self-indulgence or even social recreation. He cannot attain to absolute success except through absolute consecration of all he has and all he is to his work. He must find his reward from within, and not by accumulation from without. How many are willing to pay the full price?

Dr. Truman W. Brophy, Chicago:

A university that is complete in all its departments must teach everything. Each one of those departments is supposed to represent some special line of study, or some special branch of knowledge. The essayist has spoken of our work, of our calling, as a specialty in medicine. If we take the university, then, and extract from each of its departments all that is contained in medicine, or take, for instance, the department of medicine; if it enhances dentistry, then dentistry is a specialty in medicine. If we find after careful examination of this special branch of education, medicine, that there is not in it dentistry, or there is not in it that training and work in the laboratory and in the lecture room and in all its departments the teaching essential to make the dentist, then dentistry is not a specialty in medicine. We can take from it only that which is in it, and dentistry is not in it. Diseases of the teeth are more prevalent than any other disease known to mankind, and yet it is a fact that no medical man can deny that the curriculum of the medical school makes no provision, generally speaking, to teach this important branch of medical science.

The physician oftentimes labors against enormous odds in attempting to make a diagnosis of lesions dependent upon diseased teeth for their origin. He gropes in the dark and administers remedies when the disease is due to some local disturbance which he has not been taught to recognize. Consequently dentistry, as we accept the term to include all we teach in our schools of dental learning, is not a specialty of medicine. We might say that it is a specialty in the great science of chemistry with equal propriety. We might say that it is a branch of electricity because we use electricity. Medical men and medical faculties oftentimes labor under a misapprehension when they believe that certain subjects taught in medicine exclusively pertain to medicine. I do not wish to wander from the subject more than to say that chemistry is a science in itself; the purest science except mathematics. It has a firmer foundation, and its laws are more fixed than any other science except mathematics, and yet no one has ever claimed that mathematics is a department of medicine.

I enjoyed the President's address very much, and if you will go over it carefully and study it, as one must do, you will find that he has mentioned many subjects that have absolutely no connection with the medical school; in fact, they cannot be taught as a part of medicine.

There is no one living who has a higher appreciation of Professor Darby and his work as a teacher in operative dentistry than I. I understand why he took up the line of argument he did, but I must differ with him in some respects, especially when he speaks of whether the dentist of today is a better dentist than he of twenty years ago. I certainly believe he is. If this were not the case, I think the outlook would be very discouraging. He is a better dentist, because he is able to recognize the value of bacteriology. He is a better dentist today because he knows that when he puts something on an exposed pulp it is not a question of what it is, but it is a question of pulp infection. In the early days of dentistry, when Atkinson taught us all that when he applied oxychloride of zinc to a pulp it would keep that pulp from dying, the question of infection did not enter our minds at all. We knew nothing about it. Therefore, the dentist of today is a better dentist, because he recognizes these facts.

Dr. Darby tells us what, in his estimation, this added fourth year shall be devoted to in the curriculum. Has it not occurred to us all that the subject of irregularities, the great field of orthodontia, is enough to occupy a man's time in the fourth year, if he did nothing else, and even then he would be far from a master in that subject at the close of the year. He could take up work in porcelain which was not taught twenty years ago, as it is today, and put in all his time on it, and still he would not be a master in that department. With the advent of crown and bridge-work, porcelain work, with a knowledge of bacteriology, a better knowledge of physiology, which has been revolutionized in the last twenty years; with these I hold that the dentist of today is a better man, a better dentist; and the student of today is superior in his training as a dentist than was the student of twenty years ago. So when we sum up the work that is being done today and analyze the work of twenty years ago, I think we must come to the conclusion that the dentist of today is a better dentist than he was ten or twenty years ago. And I am confident that with the addition of one more year, and with the work better systematized than ever before, the dentist of ten years hence will be vastly superior to the dentist of today.

Dr. A. H. Peck, Chicago:

I listened to the excellent address of our President with much pleasure. I was particularly impressed with the liberality displayed throughout the address. I was especially interested in the subject of physical diagnosis, a subject which is to be brought before you more specifically by another gentleman later in the program; a subject which has been of great interest to me for a long time, and I may add that if it is possible to say truthfully of me that I have had any hobby, it is this subject of physical diagnosis. It is one on which I have laid special stress ever since I have been teaching.

I am also pleased that the discussion in the main has taken the turn it has, a consideration of the curriculum in general. I believe that this is the place for us to discuss the college curriculum. We have assembled in this association none but individuals who are interested in teaching and in getting at the best methods for carrying on their work. I wish that it would be possible for this association to give more time to the discussion of this subject, and that before an adjournment is taken a committee would present to us in crystallized form an outline of a college curriculum, based on a four years' course, that would be acceptable to all the colleges. This is a much better place and time for the consideration of this subject than the National Association of Dental Faculties.

Dr. J. H. Kennerly, St. Louis, Mo.:

The principal thing for us to do is to see if we cannot come to a unanimous opinion as to what the work of the fourth year should consist of. The suggestion was made by several of the speakers that the state boards of dental examiners adopt the plan of the board of medical examiners of the State of New York; that we give our students final examinations at the end of the second and fourth years of their course. You must remember in this connection that in many of the states of the Union examinations are not required for graduates. They are not required in this state nor in many others. If you are going to force these students, as I understand it, to be examined by State Boards every two years it would be rather an expensive procedure for them, especially in those states where they must be examined before they can practice.

With reference to the work of the fourth year: I agree with those who said that there is nearly work enough as it stands today to cover the four years if it is properly divided. But I cannot agree entirely with the speaker who said that the fourth year should be practical entirely. I believe that some didactic instruction should be given throughout the entire four years. According to my recollection of the recommendations offered by our President, we teach in the school with which I am connected all the subjects save two; and those two are physics and physical diagnosis. We go very thoroughly into chemistry, pharmacy and metallurgy so that we have but very little to add to our curriculum. The question now is,—where shall we add it?

Dr. G. V. Black, Chicago:

I would like to speak on one point that has been referred to in the discussion by one of the speakers. It is a very important point, too, in connection with this matter of education, and we should strive to understand it. The education of the machinist has been referred to, and the fact mentioned that it requires four years to make a machinist. During these four years this man may spend all his time solely in the machine shop; solely at practical work, so that he may become able to turn his journals to a nicety, cut a toothed wheel perfectly, adjust his machines perfectly, do excellent mechanical work, but if this man has not during this time been studying his mathematics and his physics, the laws of motion; and if he has not been studying mechanical drawing and all those things, he will be simply a mechanic to be directed by the master; nothing more.

Now, gentlemen, we may make men who will fill a cavity well; we may produce men who will make a plate very well, indeed, but they are like the mechanic who has stuck to his machine shop. They are men who can work only when directed by others who have had a superior education along the lines relating to the specialty they fell into in dentistry. We expect to so equip each man that he will be a master, and until we do that we are not making the dentist we wish to send out to practice. Of course, we do not expect to do all this in four years, but we must give him the basis upon which to work in the future in his practice that he may work himself up on this point.

Dr. D. R. Stubblefield, Nashville, Tenn.:

I want to present, first, a congratulation; second, an expostulation, and, third, a corroboration.

I want to congratulate our President upon the address in its entirety; broad, comprehensive, logical, intelligent. This association is to be congratulated that we begin to look at subjects so broadly. We are reaching a point where we can look over the field and intelligently decide what is best to do, and we can intelligently direct our means. As the exponent of conservative wisdom, to which we are trending, I congratulate our President in making such a showing.

My expostulation is that though all this is good, exceedingly good, yet it is utopian. I do not believe that we can accomplish that much. I am convinced that we have taught too much in the time at our disposal, with the result that we have produced a mental dyspepsia rather than assimilation, growth and development. What we want is not ingestion but digestion, so as to permit our men to grow broad and strong. We have not had sufficient time to mature. We have a smattering of many things, but "a little knowledge is a dangerous thing," and unless you drink deeply to sober yourself again you are intoxicated to your own downfall. I have always looked upon the college and the teacher as a foundation building combination. No school teacher expects to perfect his pupil, but merely to give him the material and the opportunity that Dr. Black spoke of to make himself. Put the student in the way to help himself; that is the best you can hope to do with him. Did a teacher ever make a man? No; there never was a man who was not self-made. There is no power on earth to wake up what is not in a man, and make a man of him.

We have not been able in this short length of time to give the young man a chance to come to himself; to understand what he has been filled with. Therefore he has staggered along and done as well as he could. The wonder is not that so few have succeeded but that any at all succeeded from the stuffing process in vogue in our colleges. We have cause to congratulate ourselves that some men have had intellectuality enough to digest all that was given them and make use of it.

And now the corroboration. The intelligent presentation of this extensive possible course is very gratifying. But I am satisfied, at least from my own standpoint, that what we need is more time and the cultivation of judgment. I believe that if Dr. Darby is to be sustained that it occurs out of the fact that the course was limited and the man big enough and strong enough to master that which was presented. Even in the limited time at his disposal he managed to get more out of the course than do most of our students today. He was a thorough practitioner, a man who knew; a man who could do things. It is not so much what you know as what you can do. You never know a thing until you can do it yourself.

Dr. Edmund Noyes, Chicago:

It appears to me that those who have discussed this paper are several steps behind the President's address. We do not want to add a fourth year to our dental course just to put on an extra frill or two. We must have a four years' course because we cannot do all the work in three years that ought to be done. Then we must have a hospital course or a laboratory course in special investigation work, or something of that kind. Both these things are important. Gentlemen, the greatest need of the dental profession today is to make professional men instead of artisans. We are in greater danger than most men realize, of becoming a company of skilled workmen instead of a great profession.

Previous to twenty or thirty years ago we had a few professional men in our ranks, and we had a great many mechanics and artisans, and if we are not careful the time will come when we will have the same thing again, and it will be the fault of the colleges if the rank and file of our practitioners are merely skilled mechanics and business men instead of being professional men. We shall not be without professional men, because many will become such by force of personal character, ambition and attainments. But the purpose of dental education ought to be to lift up the whole number of graduates into professionalism. If you are going to do that you must make students as well as operators and mechanical men. In order to do that you must teach them something of those sciences which are at the foundation of all professional knowledge and practice. You must awaken in the students some interest in these subjects; give them time enough to learn something about them, and the four years' course should be used more for the purpose of strengthening this aspect of dental education than for anything else.

I do not wish to disparage for a moment clinical or technical instruction; in fact, it should be made stronger rather than weaker, but the weak side of dental education today is the scientific and the professional side.

The most important thing this association can do is to ascertain and agree upon what should be taught in the first year of the four years' course. We must begin that next October, and if we know just what we are going to teach in that first year of the full four years' course we can agree upon the second year's work in time, before the second year is begun. But if we talk in general terms, as we have done so far, we will not arrive at any conclusion, and the new term will be upon us without finding us ready to say just what those students should be given for their work in the first year.

Dr. Geo. V. I. Brown, Milwaukee:

Some years ago I had occasion to take up this subject before this association. I at that time made some calculations as to the actual amount of time that we place at the disposal of students during a seven months' course, and it became clear to me that there were not hours enough in which to teach properly those subjects which were embraced in our curriculum at that time. As nearly as I can remember the figures at this moment, in a seven months' course, if you could work the student for eight hours a day he would have in actual time less than 1600 hours. Anatomy, three times a week, gives him between 80 and 90 hours of anatomy. You cannot teach anatomy, even such a small amount of it as dental colleges must require in that length of time. When you figure out the time the student puts in on each study you will find that it approximates about 70-80 hours for each branch. Manifestly it is impossible to teach those studies thoroughly in any such time as that. There is the greatest possible need for this fourth year in order that those subjects which are being taught at this time may be taught properly and still give the student sufficient opportunity to digest what he is expected to learn and understand.

In this estimate we allow only fifteen hours a week for laboratory work and practice in the infirmary, which is certainly considerably less than it ought to be. It seems to me that this association can do no better than to first consider the time that it is going to recommend for each particular branch, allowing a little additional time which will go with the fourth year, and then take up the very timely suggestions of our President with regard to additional study. I think the less time we spend discussing whether dentistry is a specialty of medicine the better for all concerned.

Until we can practice dentistry without pathologic conditions of any kind, or can prove that diseases of the mouth and teeth have no share in disease elsewhere, we must acknowledge a relationship to general medicine of some sort. What that relation is to be will depend very largely upon how we deal with just such matters as are properly before us for discussion at this time.

Dr. W. E. Grant, Louisville, Ky.:

These remarks are all very good and in line with what I have felt as to the disposition of the fourth year; yet it is wasting valuable time to talk about this matter without arriving at any definite conclusions. We have a Committee on Curriculum, and I do not see why that committee cannot report at this meeting. They may offer us the solution of this vexing problem. It is not a question as to what to do with that additional year, but how can we get the most good out of it; what subject or subjects ought to have the preference over others. Some of them are more important than the others, and it is for us to determine which of these subjects are of the most importance to the future dentist.

TEACHING PHYSICAL DIAGNOSIS.

By J. M. Patton, M. D., Chicago.

Mr. President and Gentlemen :

The invitation to present to this association a paper on the teaching of physical diagnosis to dental students brought to my notice two features pertaining to this subject which, while not unrecognized, yet had hitherto been not fully appreciated. These features are the absence, until a comparatively recent date, from the curricula of dental schools of any instruction in physical diagnosis in its relation to the administration of anesthetics, and the fact that in some quarters there has been manifested a spirit of cynical doubt as to the advisability or practical utility of introducing this branch of medical learning into dental pedagogics.

The recent introduction of instruction in diagnosis into the course of dental schools is but one of the evidences of advancement along the lines of a more general and thorough education for dental students which marks the educational methods of to-day, others of which are the courses in physiology, chemistry, anatomy, and bacteriology. Some of these are of comparatively recent introduction, and the previous apathy relative to the teaching of physical diagnosis in dental schools is to be charged against the same lack of recognition of its relative importance to the administration of anesthetics as has hitherto marked the general medical profession in regard to the employment of skilled anesthetics who have some knowledge of the physical conditions and physiologic possibilities of the organs within the chest, relations which the medical profession are but now coming to fully appreciate.

Regarding the propriety of teaching physical diagnosis to dental students there appears to me to be but one conclusion, and that is that it is not only proper but absolutely necessary, if we are to educate dentists who are capable of not only administering an anaesthetic properly, but who also have some judgment as to the propriety of its administration in the individual instance.

There are those who maintain that the latter faculty is beyond the possibilities of an education in dentistry, and is not a legitimate feature of dental practice. I am not here to controvert special argument, but, to quote Milton, "Ink doubtless, rightly applied with some gall in it, may prove good to heal this tetter of pedagogism."

Two questions arise in this connection: First, what necessity has a dentist for a knowledge of physical diagnosis? Second, to what extent is it necessary or advisable for him to carry this study?

An affirmative answer to the first of these questions hardly needs argument in its support. If the clientele of the dentist of to-day exhibited the characteristics of that old Countess of Desmond who, as related in Bacon's natural history, "lived till she was seven score, did dentize twice or thrice, casting her old teeth, and others coming in their place," it is probable that I would not be imposing myself at this time on this association. However, as modern life is not conducive to senile dentition, we must expect the painful features of dentistry to endure. We must not expect that the modern tendency to specialize in the field of anæsthetization for dental purposes will obviate the necessity for direct and correlated knowledge of anæsthesia on the part of the general practitioner of dentistry. It is not always possible to utilize special services, and even if it were it does not entirely eliminate the responsibility of the practitioner to his patient in this connection, which calls for the exercise of his individual judgment irrespective of his personal conduction of the anæsthesia. We might here paraphrase Sir Thomas Browne to the effect that "they do most with anæsthetics who could do much without them." Because a dentist does not extract he is therefore not relieved of all responsibility to his patient in regard to the employment, by some one else, of anæsthetics for extraction.

Admitting the necessity of the administration of anæsthetics by dental practitioners, the importance of a knowledge of not only the physiology of the organs of respiration and circulation, but also of the evidences of abnormal conditions of these organs, especially as far as they relate to the administration of anæsthetics, is self-evident. To minimize or deny this importance is to acknowledge a want of appreciation of the principles which to-day govern the administration of anæsthetics. These principles embody not only a knowledge of the chemical nature of these agents and of their physiologic effects but also of those physical conditions of the chest and its contained organs, as well as conditions of the kidneys, blood, and general health as may modify the physiologic effects of anæsthetics, and materially affect the extent or method of their administration.

Sentiment alone, though having no place in scientific study, has sufficient historical relation to this subject to justify a more thorough education of dental students in this branch. Who discovered the practical utility of anæsthetics? Morton, a dentist. What manner of man was he who seized opportunity, presenting in the form of Eben Frost with a painful molar, to demonstrate that though the nepenthe of Homer might be mythical "science has control of pain"? Morton, a dentist. For without discussing the claims of any one to the right of discovery of anæsthesia we may quote Sidney Smith to the effect that "He is not the inventor who first says the thing, but he who says it so long, loud and clear that he compels mankind to hear him." In this sense at least Morton's title is clear and supersedes the earlier observations of Wells. Did he not succeed where the latter failed, at the same place and before practically the same audience rendered cynically antagonistic because of the previous failure? Thus the historical interest associated with this subject gives every true dentist an incentive for the study of conditions allied to the administration of anæsthetics.

The principal questions of interest in this connection are, however, To what extent shall physical diagnosis be taught to students of dentistry? and How shall this study be carried uot?

It has been maintained that because of the impossibility of giving thorough, practical courses in physical diagnosis in dental schools to students who have no knowledge of the pathological changes upon which physical evidences of disease depend, therefore it is unnecessary and impracticable to teach physical diagnosis at all. This is shallow argument. Is the bacteriology taught in your schools useless because you do not make expert laboratory workers of your students, and fit them for original research? Is the physiology taught in your schools useless because you may not teach the chemico-physiologic relations between metabolic processes and the so-called xanthin or purin bodies? Not at all. Neither is it necessary that a dental student should be taught the histo-pathology of diseases of the chest in order to appreciate certain facts about such conditions that relate directly to the administration of anæsthetics. We should not expect to make expert diagnosticians of dental students. For him the differential diagnosis of complicated heart lesions is unnecessary. The soundness of his judgment as to the nature of a pleural inflammation does not enter into the matter. His ability to locate a cavity in the lung is beside the question.

I do not mean that these conditions are of no interest in this connection, but that their proper interpretation demands a degree of skill not to be required of a dentist, any more than you would expect technical knowledge of prosthetic dentistry of a physician before allowing him to decide as to the necessity of treating a tooth cavity.

As far as the heart is concerned in its relations to the administration of anæsthetics, leaving out of the question reflex or other inhibition of apparently healthy hearts and confining my remarks to judgment based on objective examination, the whole matter rests on the integrity of the heart muscle, and not in the mere presence of arrhythmia or of valvular lesion, a matter in which reliable judgment postulates most extensive experience and observation. Even marked degrees of hypertrophy and dilatation may not contraindicate the administration of anæsthetics provided the muscle be fairly good. It is obvious that even the most expert may be deceived, and the behavior, under anæsthesia, of some hearts that give every evidence of muscular degeneration and cause us to dread the necessity of anæsthesia, is often surprising.

We should not expect to teach dental students to become expert in judging such cases, but they may be taught the recognition of physical signs that will present to them either the absence of dangerous elements, or the presence of such conditions as render it advisable to divide the responsibility of the administration. I have examined patients who had been told both by physicians and dentists that they could not be given any kind of an anæsthetic safely, and in whom no contraindication to such administration could be found. Upon the other hand, I have examined patients who had taken an anæsthetic without preliminary physical examination, and in whom prolonged or profound anæsthesia would certainly be dangerous.

Having acquired an understanding of the gross anatomy and the essential physiology of the organs of the chest, the physiology of the blood, together with a knowledge of the physics of the diffusion of air in the lungs and the interchange of gases with the blood, essential knowledge in which, I am afraid, the average senior dental student is deficient, the student is then fitted to study physical diagnosis in its relations to the administration of anæsthetics.

He should now be taught the normal character of the heart rhythm and sounds, the characteristics of the normal pulse, the features of normal lung action and its respiratory murmur. This preliminary instruction in the normal physical signs is a very much neglected study even in medical schools.

Having acquired this knowledge, the student should then be taught the main diagnostic features of a cardiac murmur, how, when, and where to detect it. The differential diagnosis need not be considered. The nature of cardiac enlargement, hypertrophy and dilatation, and its relation to the signs of displaced apex beat, and increase in the area and force of impulse should be considered. The modifications of the normal heart sounds caused by disease should be studied, as should also pulse changes and their relation to dynamic ability of the heart. Abnormal conditions of the lungs and pleura should be considered as far as they relate to modification of respiratory capacity and obstruction of the air passages, chiefly in relation to the signs obtained by auscultation. Expertness in palpation and percussion is not essential.

The general features of blood conditions which result in degrees of anæmia which may prohibit the exhibition of anæsthetics should be considered.

The principal elements of urinary diagnosis should be taught in relation to the detection of the possible presence of kidney lesions, at least as far as chemical analysis as ordinarily taught for this purpose is concerned.

As to the general method of instruction in physical diagnosis, there is only one practical way, and that is by actual demonstration on subjects. More actual knowledge can be obtained in this way in one hour of work than in many hours of didactic instruction.

Every student should have opportunity for objective study. This method necessitates demonstration to small classes or sections, and the ground outlined can be covered in a series of from eight to ten demonstrations, and should be supplemented by quizzes in order to bring out and correct the individual students' errors.

Such a course of instruction will enable the student to obtain from his course on general anæsthesia much information which must otherwise have fallen on stony ground. Information which will be of immense practical value to him in his professional work, not only to enable him to administer anæsthetics with greater skill and efficiency, but which will also enable him to judge when it is necessary or advisable, on behalf of both himself and his patient, to obtain additional advice in relation to the possible danger of the administration of an anæsthetic.

The fact that the principal dangers, fatal and otherwise, attending the administration of anæsthetics, are of asphyxial or circulatory origin, emphasizes the importance of a knowledge of physical diagnosis on the part of the administrator of anæsthetics, for while such knowledge may not prevent the fatalities resulting from anæsthetics, all of which are not preceded by evidences calling attention to their imminence, nevertheless observation of and attention to the evidence obtained through a proper physical examination may do much to lessen both the frequency and the dangers of the various complications which are liable to arise during the administration of anæsthetics, and to some extent may affect the frequency of serious consequences arising therefrom.

The teaching of physical diagnosis in dental schools is already a fact. This cavity in the dental curriculum is being filled with golden knowledge. The students want it, and are capable of assimilating it. It has come to stay.

I desire, Mr. President and Gentlemen, to acknowledge the courtesy of this occasion, and to thank you for the attention which you have given to a paper which by no means equals in interest the subject with which it deals.

DISCUSSION.

R. H. **Hofheinz**, Rochester, N. Y.:

The paper expresses my own views so closely that, even if I were well enough, I could not add much to it.

There are some things in education which must be trusted to the individual judgment of a pupil and tend largely to his intellectual development. There are other things that summarize the results and become a part of memory. There are some things which, however, can only be studied by demonstration; yes, by actual contact. Among these belong the study of physical diagnosis. The student must commit the act.

Anything that will add to the broadening of dental education and its naturally good results should be joyfully accepted by all earnest minds in the profession. If anything new is to be added to the dental curriculum of the present time physical diagnosis is the branch which is mostly needed. Though the period in which most of the dentist's time was consumed in extracting teeth is of the past, anæsthesia will ever remain a necessity in dental practice.

I have always argued that a dentist should not trust his own diagnostic ability regarding the patient's heart and lungs, and, therefore, never give anæsthetics without consulting a medical practitioner. Why? His professional training did not equip him with the familiar sound of a normal or abnormal heart, nor was he generally able to diagnose complications in the breathing apparatus of his patient.

With this branch taught in college, the dentist possesses every reasonable qualification to anææsthetize his patient and bear the scientific and moral responsibility of a possible accident. It is, however, not only for this purpose that physical diagnosis should be taught. Dr. Peck well expressed it in his paper before the American Medical Association when he said: "I hope to see the time when a dentist will inquire into the health and symptoms of his patients before deciding on the amount of work that is proper and safe to be done at any one sitting, as should a physician before prescribing a certain amount of a drug that is to be given a patient." Yes, indeed, this is an essential necessity. How many patients are kept away from judicious and timely dentistry because the last operator lacked all judgment regarding the patient's physical endurance. We may go beyond that. How many dentists fail in diagnosing their own physical ability? How many laborious operations do we begin with brilliancy and end with mediocrity? Why? Because we have failed to recognize our limitations—failed to recognize our own physical status at that particular time. Many fine minds and hands have been made passive because the owner lacked a fine, discriminating power of physical diagnosis regarding his own and only corpus.

Under the present three years' course of study but little time will be left for the teaching of physical diagnosis. I have no doubt, however, that the coming four years' course will give sufficient room to a branch of medical science which is as essential to a practicing dentist as physiology. Prophylaxis, which in future will form one of our greatest functions, will change the requirements of the dentists of the past; but though the future dentist may be called upon to less frequently use anæsthetics for dental operations, may be less called upon to perform the long and exhaustive operations of the present time, he will be more called upon to use a broader and more comprehensive knowledge of the medical sciences.

The paternal branch of medicine from which dentistry emerged will assimilate this ramification again as soon as dentistry modifies its frequently alarming showy technics and becomes based on science and prophylaxis only.

Dr. T. B. Hartzell, Minneapolis:

Mr. President and Members of the Association:

It is an honor and a privilege to discuss this able paper presented by Dr. Patton. His views, so clearly presented to us, must meet the approval of every dental teacher who has given this subject consideration.

Personally, I thoroughly believe in the ideas presented, and only differ from the essayist as to the scope of the field physical diagnosis should cover. In view of this fact, I will not occupy your time further than to commend the paper and to suggest wherein we can make physical diagnosis of still greater value to our dental students and to the profession.

As one reviews the thought presented by Dr. Patton, one is impressed by the fact that he limits the field of physical diagnosis to its application in anæsthesia and one would also infer that to be able to fairly judge of the condition of the circulatory and respiratory system covered the most important ground of value to us. His idea seems to be: Investigating the blood, only so far as relates to the exhibition of anæsthetics, dismissing the kidneys with ordinary chemical analysis of the urine, and, while he does not so state, I infer such analysis is undertaken for its bearing on anæsthetic work alone.

Now, while every idea presented, without exception, is good and valuable, I certainly think that the field of physical diagnosis is of far greater scope, and the branch must and will be taught in many schools, and is taught now in a few, in such a comprehensive way that the student gains a conscious power and ability to be vastly more useful in his profession than if this branch is taught only for its bearing on general anæsthesia.

Dental teachers are more than ever awake to the fact that from 30 to 50 per cent of teeth lost by the American people before the sixtieth year of life are lost from causes other than caries, and that systemic conditions exist which account for this loss is equally true; therefore, sufficient general pathology should be given the student to pave the way for comprehensive teaching of diagnosis of these conditions.

For instance, the student should know sufficient physiology and pathology to comprehend the significance of variation in specific gravity, color, percentage of urea, total number of ounces of urine eliminated in twenty-four hours; also the significance of the presence of sugar, albumen or casts.

The time is coming when internal medicine will recognize in œdematous gums a more valuable diagnostic sign than the presence of fluid in the areolar tissue under the orbit, because it is a more delicate symptom and earlier makes its appearance than does the second condition, and just as surely points the searcher to the vital fact to be taken account of—namely, imperfect elimination of waste products which the kidney should convert and remove. Right here I might emphasize the fact that in anæsthetic work the condition of the kidney as regards its health is almost, if not quite, as important to the anæsthetist as is the condition of heart or lungs, for who has not seen acute uræmia follow the administration of ether occasionally? The students of the future must be taught these things to gain the greatest success.

The diagnosis of pathological conditions found in the oral cavity due to faulty elimination of the products of metabolism must and will receive greater attention in our coming four-year course. The investigation of the saliva for its diagnostic value is particularly in our field; should we not profit by it?

The investigation of the blood has helped us to valuable knowledge and will help us to more if we take advantage of such investigation; and think for a moment how much physical diagnosis along dental lines owes to the microscope? I will not stop to enumerate, for I know you agree with me that our field for physical diagnosis extends beyond the limits set by the essayist.

The relation diseases of the stomach and bowels bear, also the relation that acute febril diseases bear, to the development, existence and loss of teeth presents an interesting field for diagnosis, and one in which progress has already been made, and a field in which medicine can learn much from us. Our knowledge of anatomy, physiology and pathology of the nervous system is being so correlated with physical diagnosis that it is of great value to us in some of our most perplexing problems. For to fairly judge of the condition of the nervous systems of the people who come to us for service and to govern our actions thereby is of greater value to our patients than many of the things now taught, and should receive more attention in our course.

The diagnosis of contagious diseases, particularly of syphilis, is of vast importance, for the safety of both patients and dentist depends upon its recognition and the observation of rigid prophylaxis.

How many of you here present would care to trust yourselves or your families to the care of a man lacking the ability to diagnose this phase of disease, foryou would be apt to argue that lack of ability to recognize would entail faulty prophylaxis.

The fact of the matter is that our men should be so grounded in knowledge of disease and diagnosis as to enable them to take stock in the general condition of the patient, and of the special conditions directly affecting the teeth, more thorough and careful training than even medicine can give.

The man who limits his practice to operative and prosthetic dentistry is from one-half to two-thirds a dentist, and our coming four years' course will in many schools afford instruction that will supply the missing third, and I trust the whole weight of influence of you men who are our leaders in dental progress will be given toward the rounding out of this part of a dental education.

DR. D. R. STUBBLEFIELD, Nashville:

The Institute of Dental Pedagogics should deem itself fortunate in being able to enlist men who can so intelligently and scientifically discuss a question as the essayist in this case. As an individual member, permit me to thank him for the privilege of hearing his timely and agreeable disquisition. He has been governed by the time-honored maxim, if I may copy him in quoting wise saws, that "what is worth doing at all is worth doing well," and right well has he done it. He has given us a logical, concise, yet thoroughly comprehensible exposition of his subject, and as one who has had the opportunity of thoroughly digesting it, I wish to suggest to the membership the propriety and expediency of reading it over more than once when it shall appear in our transactions. It will repay you abundantly.

For these reasons, as well as others not so obvious, a discussion by me must be largely a corroboration and hearty approval. "Regarding the propriety of teaching physical diagnosis to dental students," he says, "there appears to me but one conclusion, and that is that it is not only proper but absolutely necessary if we are to educate dentists who are capable of not only administering an anæsthetic properly but who also (should) have some judgment as to the propriety of its administration in the individual case." All must agree with that, if the dignity and worth of dentistry is to be maintained. That its study and full comprehension should not have been deemed essential from the outset of all effort toward dental instruction is not only a reflection upon the founders of institutions so intended, but is also quite remarkable. The institution with which I am most familiar, claimed from its inception to try to teach in its curriculum everything vitally necessary to a proper educational equipment of practitioners of dentistry, and yet I am certain physical diagnosis, as such, has never been extensively offered. All dental colleges, I feel assured, teach and have always taught a technical physical diagnosis. A differential dignostic skill is absolutely essential in the daily routine of every intelligent dentist, and the man who doubts this merely publishes his own ignorance of our profession.

It seems entirely a work of supererogation to discuss the propriety of its being taught, and the questions only remain as to how far we ought to go, how much we should strive to accomplish and in what way. It is all but axiomatic that if a dentist ever does give an anæsthetic at all he sould know what is essential to qualify him for such an operation. The surgical procedure may range from minor to major, but anæsthesia never falls below the plane of its highest possibility and should never have degrees of comparison in the mind of a conscientious operator. Again, it is equally certain that every dentist, especially those outside of the realm of the extracting specialist and therefore the expert anæsthetist, has to exhibit general as well as local anæsthetics more or less frequently in his work. Therefore, it goes without saying any instruction short of complete instruction is not enough, and does not accomplish the end aimed at, as the reason for its existence in any degree whatever. Diagnosis means known throughout, and any partial knowing is only that degree that has been rightly termed a dangerous thing, and should never be tolerated where drinking deeper is possible and better. My personal conviction is that an ideal can never be too high, for there never is growth and development without stretching in mind, morals or muscle. If there is any mistake made in our work it behooves us to make it by attempting to attain higher than reasonable demand. But whatever is decided as to the degree of proficiency to be attained, I think this subject will be one of the most valuable additions rendered available in the four-year regime now at hand. It will constitute one of the most important links in the golden chain of a thorough dental education.

Again, the essayist declines to raise his voice in argument against those who maintain that the "latter faculty," as he calls it, meaning full instruction, is beyond the possibilities of an education in dentistry, but I have no such compunctions or hesitation. Why should dental schools hesitate to attempt in four years of seven months each, what medical schools claim to teach in four years of six months each? Can they claim that their material is better, better educated and more mature than is the average found in the schools of the National Association of Dental Faculties? Has it ever appeared that any educational requirement is obligatory before matriculation is possible in even the best of our medical schools? No, no such superiority exists in material to be worked on and must be found in a better or more thorough method, if found at all. Indeed, we have a right to claim that our higher fixed educational requirement gives us a better chance to produce good results. Be that as it may, the fact remains that to teach this subject well requires that specially selected clinical material be procured. It will be difficult, but not insuerably difficult. It is no easy matter for medical schools to do it, with all their outside clinic to draw from, but there is no patent right on poor, sick folks that I am aware of, and every dental faculty can command the situation if it wishes earnestly enough to accomplish things. Without posing as a prophet, I will venture to predict that such perfect practical results will be shown from those schools that survive the strenuous life the four-year rule will usher in, and each institution present could, if modesty did not prevent, disclose one of those fittest to survive.

The question is, how far shall we attempt to go in the matter? I fear that all will not agree with me in saying, the farther the better, but that is my unalterable opinion. Our essayist has made a most clear-sighted and judicious limitation, and I shall vote to endorse his views as the next best measure. Nevertheless, it occurs to me that the man who can have but little daily opportunity in after life to become proficient in such an important equipment, should, as a student, get the best possible training at college. The medical practitioner enters a school of physical diagnosis the day he commences to practice, and he should become more expert as the years go by, which is in direct opposition to the condition of the dentist, who will be compelled only occasionally to attempt an exhaustive physical diagnosis. Therefore, I repeat, that just as the dental student is given the basis for differential diagnostic skill in the special domain of his own work in the four sessions, it is not beyond reason to assume that he may be taught physical diagnosis more generally and just as thoroughly in the same time if the requirement is made. That he should not be called upon to make a critical differential diagnosis as often as the physician, or that he should not be called upon to make one at all, is no argument against the wisdom and safety to his clientele that would be found in his ability to do so if it were suddenly demanded of him. A practitioner of either medicine or dentistry, unlike a chain, is to be measured by the highest possible demand in his calling, his strongest instead of his weakest link, as it were. Having come into dentistry by the doorway of medicine, I have always been unable to look upon my calling as less important than the practice of medicine in any of its special branches and any view of its essential demands has never fallen short of the widest possible culture. Too long has the world at large been given, directly or indirectly, a narrow view of the importance and dignity of dentistry, and this idea will never receive its absolute quietus until the question has been settled in the breadth and thoroughness of the scientific qualifications found in our curricula.

Dr. A. H. Peck, Chicago:

I am glad these three gentlemen have preceded me for it leaves little for me to say, and I have never been anxious to discuss any subject unless I had something new to present. I am gratified, however, that the subject of physical diagnosis commands the attention of the dental profession in connection with our college work that it does. As I stated before, this is a subject that has engaged my attention for a long time and, if you will permit me to repeat, ever since I have been teaching in dentistry I have harped upon this subject. I believe that there is nothing in connection with the equipment of the dentist, in the broadest sense of the term, that is more essential than an intelligent understanding of this subject. The ability to diagnose accurately local conditions, and also conditions of a systemic nature upon which many local pathologic conditions depend, is one of the most important of our qualifications and I am glad that a number of our colleges have considered this subject of sufficient importance to give it a separate place in the teaching force, and I hope that in the very near future all of the dental colleges will give this subject the place on their curricula that it deserves.

As Dr. Hartzell says, I would differ only in the scope of the application of this subject in teaching dental students. While I believe that it is impractical at the present time to undertake to give a course to dental students in this subject, as broad and comprehensive as the course that is given to the medical students, yet I do believe that such a course is exceedingly desirable, and if it were possible, considering all the conditions with which we have to deal today, I should most certainly heartily support any movement which has in view the inauguration of a practical course in physical diagnosis. It is very essential that the dental student leaves his college with a mental equipment in physical diagnosis that will compare favorably with his knowledge in any other subject.

DR. W. H. WHITSLAR:

An amount of physical diagnosis of dental patients under varying conditions is a necessity. This is especially true when the candidate is to be a subject of anæsthesia. It is well to understand some of the means of arriving at the diagnosis of disturbances of the heart and lungs. A short course in our curriculum is desirable and this, I believe, should be largely illustrated with manikins first, to recall the anatomy of the vital organs, then to localize the organs. Afterwards the human subject may be secured from the clinics and the student taught to recognize usual and unusual sounds of the thorax. In so far as the teacher is able to secure subjects, so will the value of the course increase. It must be averred, however, that physical diagnosis of lesions of the heart and lungs is not to be mastered in a short course. When cases in practice present themselves, however, that are eminently suspicious, that fact is all the more observant to the mind that has had some training, be it ever so little. This course should be clinical as much as possible.

There is another phase of this subject that seems to me sufficient to command attention under another chair. I refer to the examination of patients entering the operatory for the usual dental operations. While it often seems impracticable to devote much time on the part of students to the incoming patients as a body, yet I have had for a long time the desire to have systematic examination of every patient that enters the college. Many things are attained by such procedure. As a rule the patients are examined by a demonstrator, and he assigns them to respective operators, where mechanical affairs precede all other thoughts. Now, in the hands of a demonstrator, in a examination room for the whole purpose of examination, a student learns to receive a patient, seat him, observe temperament, condition of health, conformation of jaws and face relative to the teeth, mucous membrane of the mouth and throat, abnormal growths, presence of calculus upon the teeth, gingivitis, pericementitis, abscess and fistulæ, other pustular diseases, decayed teeth, and many other conditions that an intelligent demonstrator could teach the tyro to become observant, inquiring and intelligent. In this study the act of paipation would help the diagnosis of an abscess, and percussion the resonance of the tooth indicating its vitality. The senses of sight and smell are also called into use.

On the whole, I think that the establishment of instruction in diagnosis is of so much impotance that it is a wonder that it has not been introduced heretofore.

Dr. Faneuil D. Weisse, New York, N. Y.:

The teaching of physical examination to dental students was commenced at the New York College of Dentistry about ten years ago. At that time a class was organized which every student of the second year has since been required to attend. It seemed to us that it was absolutely necessary that a dental practitioner should be able to recognize the normal pulse, normal heart sounds, and normal lung sounds; but, that it was not necessary that he should know how to differentiate abnormal heart and abnormal lung sounds. If he was able to determine that the pulse, the heart sounds or the lung sounds were not normal, it would deter him from administering an anæesthetic and lead him to direct the patient to his or her family physician for advice as to the propriety of administering an anæsthetic.

This class has broadened, since its organization, in that the class work now includes the practical demonstration of and drill in the application of measures to be carried out in the emergencies of syncope ,asphyxia, and hemorrhage—the dental surgeon should be educated to met these emergencies—in addition the students are taught the application of bandages to the head.

Each class consists of ten students, who examine and operate upon each other; the instructor of the class is a physician.

First—How to feel the pulse is demonstrated, what is to be recognized as the normal pulse and its age variations are noted. Each student then examines the pulses of his fellow students under the guidance of the instructor.

Second—The examination of the heart is demonstrated, and what is to be recognized as normal heart sounds is described. The students then examine each other—they being stripped to the undershirt.

Third—The examination of the lungs is demonstrated and what is to be recognized as normal lung sounds is described, and the normal ratio of the pulse to the breathing is given. The students then examine each other—they being stripped to the undershirt.

Fourth—The administration of an hypodermic injection is demonstrated, and each student administers an hypodermic injection of sterilized water to a fellow-student. The several drugs used for hypodermic injections are then enumerated, and the special indications for the use of each given.

Fifth—The subject of hemorrhage after extraction is dealt with; the various measures resorted to are enumerated and their applications described.

Sixth—The various methods of artificial respiration are demonstrated, and the students are drilled in practicing each method upon each other.

Seventh—The application of head bandages is demonstrated, and the students are drilled in applying them to each other.

Eighth—The treatment of syncope and shock are described and measures to be resorted to given.

A written examination is passed on the work done and the passing average is 75 per cent.

DR. L. C. BORLAND, Chicago:

I was very glad, indeed, to hear Dr. Weisse's remarks on the subject, as I have been trying to carry off the credit of having introduced this great controversy among the dental profession. I first advocated the study of the heart and lungs by dental students about ten or eleven years ago. My object was to try and interest them in the heart, which they were compelled to take up in the dissecting room. Some seven years ago I brought to the college during the annual clinic two boys, one having a normal heart and the other an aortic stenosis. I had combination stethoscopes, so that ten or fifteen could listen to the sounds at the same time, and as the members of the dental profession passed through the room I asked them which of the two cases they regarded as the normal and which the abnormal; to which of the two they could administer an anæesthetic in safety. I was astonished to find how few of these men were able to distinguish between a normal and an abnormal heart. That may be taken as an evidence of the necessity of a course in physical diagnosis, at least so much of it as is of service and necessity to the dentist.

Dr. Patton (closing the discussion):

The advisability of teaching this subject appears to be admitted. As Dr. Stubblefield remarked, perhaps it was a matter of supererogation to introduce that question at all. I did not introduce this matter of teaching physical diagnosis because I thought there was any doubt in the mind of the dentist as to its place on the dental curriculum, but because there was such a doubt in the mind of the medical man. They think that the dentist should not be taught this subject because we cannot teach him enough of it in the short time placed at our disposal. I do not feel that way; I feel that the dental student can learn it and that he should be taught it, and that it will do him much good.

As to the question, how much of this subject should be taught: As I stated in my paper, I consider the subject from the standpoint of the administration of anæsthetics, but that is not the whole subject of physical diagnosis. A great deal more might be taught in the dental schools that would be of benefit to the dentist. The question is whether you are shaping your curriculum for the purpose of making a dental practitioner, or whether you intend to make a research worker of him. I do not believe that it is advisable at present to require every dental student to take a thorough course in physical diagnosis, including diagnosis of the urine, blood and all the secretions. Certain portions of diagnosis coming under the head of clinical diagnosis should be taught, and this should be done in the laboratory before the student reaches his course on physical diagnosis.

I think that the dentist should be educated to the point where he is able to determine if there is something wrong about the patient; knowledge that is of value in reference to the amount of dental work to be done on that patient; on the question of the advisability of giving an anæsthetic, or which anæsthetic, or how much of it should be given. Such a knowledge is of practical value to the dentist in his every-day work.

I have confined my paper to the question of physical diagnosis of the various organs in relation to anæsthesia, because I believe that is the most practical point from the teaching standpoint today. I believe with Dr. Borland that those methods should all be objective.

You can talk to a man for a week about a heart murmur and yet he will not know what it is. But show him that murmur, let him hear it, and he will know all about it in five minutes. I showed a patient to a medical student the other day; the student had been studying physical diagnosis for two years. I demonstrated a common point in a mitral lesion of which he had no knowledge other than the theoretical. In two minutes I gave him the necessary practical knowledge. That shows you the difference betwen practical and theoretical teaching.

The presence of a heart murmur has nothing to do with the administration of an anæsthetic unless there is some condition of the heart muscle which would contra-indicate the use of an anæsthetic. It is entirely a question as to the integrity of the heart muscle and that is something that you cannot teach the dental student, or any other student, in four years. He is lucky if he learns it in twenty years; that is, with any degree of proficiency. What the dentist should learn is to differentiate between conditions or murmurs; what a heart murmur is, when you can hear it, where it can be heard and how. He should learn that it is present and that is all. He has nothing to do with the decision of the question whether that murmur will interfere with the administration or not. That is beyond his scope.

THE SYSTEMATIC ARRANGEMENT OF LECTURES ON OPERATIVE DENTISTRY.

By C. N. Johnson, L.D.S., D.D.S., Chicago, Ill.

In presenting any subject to a class of students in the lecture room it is necessary, if the best results are to be obtained, to so arrange the headings that the order of presentation shall carry the subject in a regular sequence from the fundamentals to the minutest details. Not only this, but in a descriptive subject like operative dentistry, where the lecturer must picture with words the mechanical procedures of operations, he would better so plan his lectures that they follow as nearly as possible the order of the operation in the mouth. A student can better grasp a thing and retain it if it is presented to him step by step in its logical development with suitable landmarks at various points for the purpose, so to speak, of staking off the field of thought.

Different teachers probably have different ideas of what should be included in a course on operative dentistry, and no hard and fast lines can be drawn to divide the various subjects in such a way that it will apply to all schools. Each professor must arrange his work as best suits his individual needs and in a way to harmonize with the work of his associate professors in other departments. In the present paper no attempt will be made to specify in detail the topics to be considered in a series of lectures on this subject, nor to speak of the division of the work in the different years of the college course, but merely to use some of the standard topics as a means of illustrating the order of presentation to the class, and also to show how some of the topics may be divided into heads and sub-heads to make the lesson more vivid and the train of thought more systematic.

In teaching operative dentistry the class should first be impressed with the fact that no filling operations should be undertaken till the mouth is rendered hygienically fit to receive them—in other words, till all deposits are removed and the teeth properly cleaned. This involves at the outset a consideration of the subject of deposits on the teeth. This subject may be divided as follows:

Kinds of deposits; source, how deposited, distinguishing characteristics, location, and deleterious effects of each kind.

Removal of deposits; instruments and instrumentation, appliances and accessories, materials for the removal of stains, with the technique of the operation from beginning to end. In this connection it is well at an early stage of the lectures to make the lesson more impressive by calling for a volunteer from among the students to take a chair in the front of the class. The lecturer then demonstrates upon him the different plans of procedure in the removal of calculus from the various surfaces of the teeth. He can show the best positions to be taken by the operator, the manner of placing the patient, the method of bracing the operator's hand to guard against injury to the gums in the use of push-cut scalers, and other valuable suggestions of a practical nature which the entire class can see and appreciate. A few minutes' demonstration of this kind will make a more lasting impression upon the class than a whole hour's cut and dried lecture, and wherever through the course an opportunity presents of making a demonstration that all of the students can see and grasp, it is well to do so.

When a thorough grounding has been given in the best means of placing the mouth in a hygienic condition, the class should be told how to instruct the patient in the care of the teeth—the methods of brushing, the frequency, and all of the relationship existing between patient and operator, with their respective responsibility in maintaining oral hygiene. No opportunity should ever be lost by any lecturer to inculcate the principles of true professional relationships in the minds of his students, and it so chances that in presenting the subject of operative dentistry these opportunities occur very frequently.

Keeping the patient always as vividly as possible before the students in the lecture room, the next thing to consider after "deposits" is the subject of dental caries. That would come next in the order of work at the chair and it should therefore come next in the lectures. The etiology of dental caries need not be dwelt on in detail because that belongs to another chair, but there is a certain phase of the disease upon which it would seem desirable for the lecturer on operative dentistry to express emphasis. This relates to the manifestations of immunity and susceptibility, to the question of tooth material as it has or has not a bearing on the carious process, and to the possible relation of dental operations to the establishment of immunity in susceptible mouths. All of this has a most intimate relationship with operative procedures and it tinges the treatment of caries throughout. Then, again, great care should be taken to show the student the modus operandi of decay, the positions on the teeth where decay most often begins, with the reasons. This bears closely on the philosophy of cavity preparation, which immediately follows in its regular order.

The first thing to consider on this subject is the classification of cavities, with the reasons why cavities are so divided. Then take up the various classes and give each the special treatment it requires. For instance with proximal or proximo-occlusal cavities the first requisite in operating is to obtain space—with reasons. This at once takes us into a consideration of the significance of the interproximal space, the contact point, and kindred topics. When the necessity for obtaining space in contour work is thus impressed upon the student, the next step is to consider the different methods of separating teeth, with the indications for or against each method. This involves the question of materials for gradual separation, and the manner of using them; also the means to be employed in immediate separation or heroic wedging, such as the wooden wedge and the various kinds of separators, with the philosophy of force on which each one is based. In dealing with any appliance like the separator before a class of students great stress must be laid on the dangers from an indiscriminate and careless use of it.

After space has been gained the next consideration of the operator is to exclude moisture from the teeth during the operation, and this leads the lecturer into a study of the reasons why moisture is a bar to perfect work, followed by the various means to be employed to secure dryness. No detail of this should be slighted at this time, for instance when the use of the rubber dam is under consideration, it should include the kinds of dam, the size to be used for various positions in the mouth, the number of teeth to be embraced by the dam for each operation, the manner of punching the holes, the detail of applying it, together with the means of securing it in place during the operation. This includes a study of clamps, the various kinds of clamps, the indications for or against their use, their abuse, how properly to use them, together with the same line of treatment on ligatures and other means of retaining the dam. No detail of the actual operation should escape attention at this time, and the same with other plans for keeping cavities dry beside the rubber dam.

When dryness has been secured the actual preparation of the cavity begins. With proximal cavities there are several chief considerations which stand out prominently as landmarks for the student's identification. The first is the outline of the cavity, which involves the question of extension for prevention and the philosophy which underlies it, the next is the form of the cavity walls for retention of the filling, the next the removal of decalcified tissue in the deeper portions of the cavity, with the issues at stake pro and con, and finally the preparation of the enamel margins.

Then comes the technique of the operation—the instruments used and the manner of using them. This latter is also to a certain degree a review of the preparation of the cavity, stating, as it does, the form of the cavity walls in outlining the instrumentation.

Each class of cavities should be considered in the same detailed way, and then a note made of the exceptional cavities which sometimes occur in such a manner as to well-nigh defy classification. Unless something is said on this point the student is likely to be puzzled on encountering a cavity which he cannot classify, and instead of using his judgment and studying out an intelligent plan of procedure he will frequently stand helpless in the face of what he conceives to be the unknowable. The aim should be in all college teaching to develop the individual thinking and reasoning faculty of the student, and the exceptional cases form an excellent medium for emphasizing this.

In connection with the preparation of cavities the subject of hypersensitive dentine comes up and must be considered in all of its phases, the medication (in brief), the instrumentation, and the temperamental control of the patient.

The next subject to be taken up after cavity preparation is filling materials. The list of filling materials and their combinations in use at the present time should first be given, and then a detailed consideration of the physical character of each material and each combination. This leads to an observation of its advantages and disadvantages, together with the indications for or against its use. A brief outline may also be made of the methods of preparing filling materials for the purpose, though the chemistry of this subject belongs to another chair.

The method of manipulating and inserting the material in the cavity should be considered precisely in the order in which the operation is performed in the mouth. For instance, in dealing with gold, after studying the characteristics of cohesive and non-cohesive gold, the subject of annealing gold, and getting an insight into the various forms of gold on the market, such as crystal gold, deposit gold, etc., the question of the force to be applied in condensing gold naturally brings up the subject of pluggers and mallets. Before a mallet is used it should be well understood, and this involves a study of the condensing power of the different kinds of mallets, together with the philosophy and applicability of hand pressure. In considering the use of the mallet the effect of its impact on the peridental membrane calls for a close observation of the best methods of using a mallet, and also of suitable means for protecting the peridental membrane against injury from mallet force. With all of this vividly in the mind of the student, he is in a receptive mood to follow the insertion and condensation of the filling. The manner of building up the gold in the different classes of cavities should then be explained in detail, the placing of the pellets or cylinders of gold, the direction and force of the mallet blow, the form of pluggers for the various positions, and all of the minutiae of the operation to the final hardening of the surface of the filling by repeated mallet impact.

The next consideration is the trimming and polishing of the filling with the various appliances and materials for that purpose, thus carrying the operation to its logical conclusion.

This same method of treatment must now be carried out with all of the various filling materials, including inlay fillings, which latter require a very careful and a really specialized consideration in view of the radical difference in principles involved from that of ordinary filling.

The next subject for discussion is that of the dental pulp. It frequently becomes involved in filling operations and might therefore be thought suitable for consideration in connection with the preparation of cavities, but it is a subject so different in character from that of filling teeth that it is deemed best to reserve it for a special place in the lecture course.

The approach of decay near or to the pulp raises the question as to whether the pulp shall be protected and saved or destroyed and removed. The indications for and against pulp capping should be very carefully considered in view of the importance of the subject, and then the methods given for capping the pulp in those cases where the indications are favorable. The different means employed for destroying the pulp in cases of hopeless exposure should then be considered with the indications for or against the methods. This involves a study of sealing agents for the cavity during treatment and all the means to be employed for safeguarding the soft tissues against injury in the use of escharotic agents in pulp destruction.

When the pulp is removed the next subject in line is the preparation of the canals for filling, the management of small and tortuous canals and all of the technique of this important operation. Then comes root filling, with the materials to be used and the manner of using them.

The consideration of dental alveolar abscesses in their pathological and surgical aspects comes under the head of other chairs, but the operative procedures involved are properly within the province of operative dentistry and may be considered at this stage.

The study of erosion, abrasion and kindred topics also demand attention from an operative point of view.

Then comes the management of children's teeth, the teeth of nervous individuals or those broken in health, and the teeth of elderly persons.

This, with a general summing up of the whole subject, and the practical consideration of the keeping of records of operations, and other office management so far as it relates to the conduct of the operating room, rounds out what may be made a very complete course of lectures on operative dentistry.

In thus outlining topics for discussion no attempt has been made to arrange the details of the various topics except in one or two instances, very briefly, by way of example. It is left for the individual lecturer to formulate his headings in his note-book as best serves his individual purpose. This does not imply that this arrangement is a matter of secondary importance. In fact, to cover the subject adequately and with the smallest loss of time, it is of the highest importance that systematic and sequential headings be formulated for every topic, but in the opinion of your essayist this is as far as note-making for the lecture room should go. In other words, the lecturer should so prepare himself upon his subject that he does not require any prompting from his note-book except merely the headings, and those only for the purpose of keeping the subject running consecutively and to avoid any possible omission. The moment a lecturer has to consult his note-book for anything more than this, that moment he loses the magnetic influence over his class, which is one of the chief factors in every lecturer's success. Nothing in the way of reading from the note-book should ever be tolerated in a subject like operative dentistry, and if a lecturer finds it necessary to do this there is only one of two things for him to do—either make himself so familiar with the subject that it pours from him spontaneously without prompting, or else resign his chair and take up other work less laborious and more suited to his inclinations.

As a suggestion of how the headings in the note-book may be arranged for each topic, the following is offered as an example in cavity preparation:

PROXIMO-OCCLUSAL CAVITY IN BICUSPID.

1st. Cavity outline—Why?

2nd. Forming cavity for retention. Gingival wall—Why? Buccal and lingual walls—Why? Anchorage step—Why?

3rd. Removal of decalcified dentine in deep portion of cavity. Rules—with reasons. Treatment.

4th. Enamel margins.

5th. Technique of entire operation.

This may seem a very bare outline and yet those headings contain material enough for several lectures. There is no objection, of course, to a lecturer making a greater number of subheadings for his guidance, but the better way, according to the writer's notion, is for the lecturer to go over the subject the evening before his lecture, and so saturate himself with the topic that notes are unnecessary. There is an inspiration to the class in a spontaneous and off-hand presentation of the subject free from repeated recourse to the note-book and with the lecturer constantly looking his students in the eye, that can obtain in no other way. Not only this, but the details of treatment in the various topics of operative dentistry change from year to year as our ideas change, so that the re-writing of detailed notes each year would become burdensome. With headings this is not so much the case, and the changes necessary are very slight. This does away with the baneful habit of attempting to lecture year after year from the same old musty set of notes.

DISCUSSION.

DR. W. S. HOSFORD, Iowa City, Ia.:

MR. PRESIDENT:

I am in such thorough accord with Dr. Johnson that I cannot criticise anything he has said. I can only accentuate one or two points mentioned by him. First, the preparation of a diagram or syllabus of each lecture; this to be placed on the board so that each student can copy it and use it as a means for future study and collateral reading, as well as recitations on this subject. The use of teaching models and instruments for demonstration is also a good point.

Most of us are coming to the semester plan of dividing our college course; each semester to consist of nine weeks during which time the student is taught certain subjects or parts of subjects. At the end of each semester he is examined in that subject or part so that we can ascertain just what results we are getting in our work. I believe that is a very good plan. Personally, I wish to thank the essayist for the very clear and logical paper which he has presented. It cannot fail to be productive of much good.

Dr. George E. Hunt, Indianapolis, Ind.:

According to his paper, Dr. Johnson does not begin teaching operative dentistry where I do. I first take up the anatomy of the mouth and endeavor to impress my students with the idea that I know all about the muscles of mastication and the osseous tissue entering into the oral cavity and its adjacent parts. I then take up the anatomy of the teeth and follow that with lectures and quizzes on development and on histology. I am then ready to talk on operative procedures. In these lectures I also teach oral pathology and therapeutics. To my mind oral pathology and therapeutics are inseparable from the teaching of operative dentistry. The same lecturer should handle these subjects. When I begin talking on the conservation or extirpation of the dental pulp I just have to talk pathology and therapeutics, and I do so.

I do not agree with Dr. Johnson that a lecturer should not write out his lectures. I do agree with him that the lecture should not be read. There is no chance for argument there. But I write out my lectures quite fully and take the manuscript to class with me. I may not look at it once during the hour but writing them out impresses them on my mind and I do not leave out things I had intended to say. It is before me simply as a memory refresher.

It has been argued that this method insures the lectures being the same year after year but that is not so with me. Every other summer I rewrite my entire course and all through every year I am adding copious notes to those I already have. In this way I am far more likely to be in position to give my students the benefit of all that seems good in operative dentistry than the man who relies on memory alone. In fact, the man who relies on memory alone is apt to be a narrow teacher. He teaches only what he does; other methods are neglected.

Dr. Henry W. Morgan, Nashville, Tenn.:

It gives me great pleasure to add my word of approval to the essay you have just listened to, and when it has been re-read by teachers of operative dentistry and a syllabus made, it will be found to cover very thoroughly every subject properly belonging to that chair.

In those institutions where a text book on dental anatomy is not used, a series of lectures on Dental Anatomy would come in logical order before "cavity nomenclature." It has been my privilege to teach this subject to the students of the first year, thereby giving me an early opportunity of becoming acquainted with the class and thoroughly grounding them in the nomenclature which is to be used in the lecture room, and technic laboratories, of the second and third year.

The essayist's plan of arranging the subject of the course in the order of the "operation in the mouth" seems to me both wise and sound. It affords both student and teacher, at any time in the session an opportunity to reflect upon and digest the work already gone over, and permit the introduction of outside subjects, without breaking the continuity of the course, so naturally does the subject already considered suggest that which is to follow.

I feel that when I have endorsed the idea, I have really endorsed the paper as a whole and have left little to be said, since there is nothing to take exception to. We are to be congratulated, as well as the essayist. In my work I have always added after the removal of calculus from the teeth and treatment of the gums, a lecture on tooth powders and mouth washes.

I most heartily approve the declaration of the essayist, that the aim of all college teaching should be the "development of individual thinking and reasoning." Dogmatic teaching is therefore to be avoided. We should rather appeal to the intellect of the student than his memory. If you will pardon a personal allusion, I will speak of one other point in the paper, I have always felt the need of notes referred to, and while there can be no debate of the proposition laid down that they should be few and brief, that the lecturer should command the eyes of his students, if he would reach their souls and stir their enthusiasm, a full list of properly arranged topics will frequently enable a speaker to present in logical sequence a subject, without which, he would say but little worth a student's remembering. Nothing tires a class so quickly as a teacher reading from his note or any other book. It is fatal even to have to consult an authority before a class, in fact there should be no book taken into the lecture room to be consulted. It is much better to admit ignorance than to be detected in a pretension. Candor, frankness, simplicity, these are the attributes which should characterize the teacher's attitude toward the student. High sounding technicalities are cloaks for ignorance. The essay under discussion is a fine example of the fact, that a man with a message needs no high sounding phraseology or ambiguous terms.

Dr. H. L. Ambler, Cleveland:

The good sensible essay to which we have just listened, might be termed the philosophy of teaching operative dentistry, because it proposes the application of philosophical principles to the process of teaching for philosophy does not necessarily deal with another world, but with present facts, and they are what the teacher encounters at every lecture and demonstration, and "he must take his bearing from the fixed stars, and not from the shifting scenes and lights of the lower atmosphere."

"The philosophy of teaching is the explanation of the teaching process by means of universal law. By it the separate acts are brought not only into unity among themselves, but into the unity of the complete system of growth."

There is some science in teaching, but we feel that there is a great deal of art, and from what the essayist has written we think he has fully exemplified this fact. We do not go beyond the bounds laid down by the essayist, when we refer to what a teacher should be. The born teacher has tact and personal insight which he brings to bear in every act of teaching, and he knows that great gain is made by planning his work, universal law guides his hand and inspires his heart.

The essayist has shown that his teaching is a process consisting of a series of well defined steps, which he takes to bring about the much desired end, and all good teaching has these organic elements. A knowledge of the results of previous methods in teaching is necessary for the conception of useful ideas, and for the system of carrying these into effect. Strictly speaking, teaching is a mental process, but a great deal of dental teaching combines the mental with the mechanical process, and some go so far as to claim that the diagram method, model method, and laboratory method are the vital ones.

That the order of presentation of any subject should be carried from the fundamentals to minute details, as the essayist proposes, is certainly the proper method, and thus it is well for example, in presenting filling materials to a class of students to begin with the simplest and easiest understood and manipulated, viz.: gutta-percha, cement, amalgam, tin, and gold; treating of their physical and, to some extent, of their chemical properties.

In operative dentistry a large portion of the teaching is didactic, but we believe any lecturer will find the need of at least partially demonstrating some of his lectures, so as to be sure that the class understands him; a large part of the remainder being left for the chair of operative technics and the demonstrators in the operatory. After lectures and demonstrations on a given subject have been completed, there should be a sufficient number of quizzes held, so as to be sure that the student comprehends all of the main points presented, and to correct all false impressions, and the student will often remark, that the quiz was of as much value to him as any portion of the work.

If demonstrators have been taught in your own college, they will be familiar with your way and try to apply it, thus saving time and perplexity; it is much better for a student to know one good way of doing a certain thing than to have faint ideas about two or three ways of doing the same thing.

It has been said of the Englishman in general, that he is nothing if not systematic. If we could truly make this apply to all dental teaching, then it would be a step in advance. The courses in different colleges are largely the same, but even if a teacher does overlap the work of some other chair, it does no harm provided they are in agreement, because there are many things that a student needs to be told about more than once. What one chair does not teach another should, and this can be determined by the teachers going over together a list of the subjects they think properly belong to them, and at the same time considering the extent of detail each one cares to teach.

We observe that the essayist does not rely entirely upon didactic teaching, and here we agree with him, and have often called for some member of the class to act as a subject for demonstration, for students generally prefer to see a thing done, rather than to hear it talked about, and if they remember anything, it is what they see.

The manner of studying is of as much importance, as how we study and what we study. A student should be taught to remember principles, and not phraseology, and then there will not be a struggle at quiz time to recall some forms of words: this is one objection which has been brought against printed questions and answers.

It would redound to the advantage of both operator and patient, if more instruction was given students in oral hygiene, the teaching of which should include the care of bridges, and all prosthetic work, and this naturally comes to the chair of operative dentistry, unless there is a special lecturer on oral hygiene, which some colleges have.

In a recent newspaper we saw a dentist's card which read, "Dr. B——, Prophylactic Dentistry." Was he not aiming in the right direction?

The essayist makes a slight reference to ethics; we believe that subject should be taught by the chair of operative dentistry, if there is not a special lecturer, as a few schools are fortunate enough to have, but the matter should be well exemplified by all the teachers, and referred to whenever occasion permits.

Porcelain inlay operations may or may not be considered by the chair of operative dentistry, as agreed upon by this chair and the one of prosthetic dentistry, either will answer, only so the student obtains the necessary instruction.

Erosion, abrasion, and we would add atrophy, all to be treated from an operative standpoint, should be included in the chair of operative dentistry.

If there is not a special lecturer on dental history, we think a few lectures and quizzes—not less than five or ten—should be devoted to it by the chair of operative dentistry in every college, thus adding dignity and respect to our calling. No other profession would consider such a proposal as not to teach their students the history of their specialty, and they often add collateral history. Doctor Brophy in his address at Stockholm said, "The leaders in educational work, both general and professional—excepting professors in dental colleges—have but a meager knowledge of what dentistry is, and what the varied and difficult duties of the dental practitioner are, while many people of culture, people well informed on almost all subjects, have only the most crude ideas of dentistry and dental practice." This being the case it seems highly important that we should instruct the student in history so that we can help educate the public in this respect.

Any lecturer is liable to make an entire omission, or to misplace a part of his subject if he does not use note headings; it is better to use them and thus place a subject before the class just right the first time. It is not easy to undo mistakes; the first statement made is the one that the student is most liable to remember, it is like being introduced to a person who is incorrectly named to you, and afterwards you learn his real name, but you never see him without calling to mind his incorrect name. Mistakes may not ruin the teacher, but they injure the student. Ignorance of the teacher is not a valid excuse, because the fact of his accepting the position implies a pretension to the proper skill and learning.

Teachers must originate and guide their classes; they should be men who stand in the front rank of their specialties as scholars, thinkers, and investigators, and be thoroughly versed in its literature, and of broad mind to enable them to see the relation of their specialty to the entire body of science.

There is a degree of natural talent, of mental power, which all consider desirable in a teacher, and surely he should have an earnest desire to make himself useful in the highest degree to those whom he teaches.

Every teacher who occupies a chair should be so imbued with the importance of his own work, that he thinks all other chairs are of secondary importance; to such men as these we are indebted for very much of our progress, because they think, reason, and invent along their special line, and they talk about the good things they know, and they push them along to success. Given a faculty composed of such strenuous men, they will constitute the very best faculty a dental school can possibly possess, and they will attract and impress students as no half-hearted men can; their highest reward is an approving conscience and the satisfaction of bringing their pupils up to the highest attainments. We believe, as a rule, that students will pay attention to the chair of operative dentistry better than any other chair, for the average senior cannot see anything but a gold filling, and it is about the height of his ambition to produce a perfect one.

Immediate results are not always the best; it takes time to impress a student, and more time to produce a good dentist. Great advancement has been made in ways and means of teaching, but perfection has not appeared. The method which the essayist has given us is systematic, cumulative, and brings a proper and natural sequence which makes it very interesting to the student. We might say that the accomplishments of a lifetime have been put in an hour-glass."

This is an age when the man who thinks and reasons, is the one most likely to succeed, and the public will look for him in all departments of life, and dental schools should do their part in developing these qualities.

DR. GEO. E. HUNT, Indianapolis, Ind.:

Dr. Ambler stirred me up on the teacher question, and I want to say a word on that subject. I believe that the good teacher in dentistry, or anything else, is the man the boys love. I would not give the snap of my finger for any teacher on any subject whom the students do not like. A teacher should be able to carry his boys with him all the time, no matter whether he is choice in the selection of his infinitives, or whether he indulges in the use of a little slang now and then. When he talks the class should believe every word he says; they should be his, no matter what language he uses to express his thoughts. You know that as a rule the sky-soaring orator is not the man the boys put much faith in, and I don't blame them. Carry your class with you and you will be a success as a teacher.

DR. W. C. BARRETT, Buffalo, N. Y.:

It would appear that Dr. Hunt, judging from his remarks, teaches anatomy, therapeutics, something of materia medica, all of pathology, orthodontia, operative dentistry, and several miscellaneous subjects from his one chair. It seems to me that that is concentrating altogether too much in one little body. I do not know how deep his pond is—as far as I know it is unfathomable—but I should imagine that it would run dry after a while. I cannot conceive that that is the best way for the average man to teach. It cannot be thorough. For my own part I teach pathology, nothing else, and I give about sixty lectures on oral pathology alone without attempting to make any reference to an instrument or its use. It is my good fortune to be connected with the same faculty with which the essayist is connected; we have interchanged ideas on the subject of our mutual duties and we have no clashing whatever, and he gives a thorough course of lectures. I give as thorough a course as I can. He talks about operative dentistry, and I about pathology; and we both have all we can do. I believe that in the early days of teaching in dentistry all of pathology was taught from the chair of operative dentistry; but I am of the opinion that we ought to have gotten beyond that by this time. Pathology should be a chair by itself and not a branch, and a small one at that, of some other chair. There is certainly enough to teach in operative dentistry proper to occupy all the time and attention of one professor, even a man as capable as Dr. Johnson.

I think we should differentiate between the practical part and the theoretical; that is, betwen the practical and theoretical part of operative dentistry. Operative dentistry in its most exclusiveness is the foundation of dental practice, and it certainly should occupy all the time that one man can give to it in one course of lectures. The theoretical is the real pathology, not simply the symptomatology, but a study of the pathologic changes which take place within the tissues as a result of malnutrition. That is not properly a part of the department of operative dentistry and I am glad that Dr. Johnson takes the same view of the subject that I do. He has all he can do to teach operative dentistry, according to the Johnsonian standard, and so will any one else in that department, or in any other if he sticks to the subject in hand.

Dr. H. A. Smith, Cincinnati, O.:

Dr. Johnson has given us a most excellent paper. I came here especially to hear the paper and I am not sorry that I came. I wish now to refer to what Dr. Hunt said of the regard the student should have for the teacher. I would infinitely rather have the respect of the student than his love. I think it is going too far to attempt to have a class love the teacher. If I can get the respect of my class that is all I can hope to get.

As to the point Dr. Barrett made with reference to teaching pathology: I understand Dr. Johnson to say that he taught some pathology. I think he teaches more than Dr. Barrett thinks he does. I do not see how any teacher of operative dentistry can make his subject clear to the student unless he teaches something of the pathology of dental caries for example. I teach special pathology, but the general subject of pathology is remanded to the lecturer on that subject. I think it is a good plan to have the general subject of pathology taught by a special teacher, but let the teacher of operative dentistry talk pretty fully on what is called oral pathology.

With regard to the method of following notes while lecturing: Dr. G. V. Black, who is known to be a superior teacher, told me a number of years ago that for many years he had burned everything behind him each year. He said that he had never kept any notes excepting perhaps, some statistical matter which had caused him a great deal of work. After a time, when you become experienced, it will not require much time to make fresh notes. If you are a constant student of dental literature it will not be hard.

I am surprised that Dr. Hunt could not succeed in the way indicated. A man of his ability and experience should not fail even if he has not his notes before him. I know from my own experience and observation that the man who delivers a lecture with the fewest possible notes is the most effective teacher.

Dr. M. C. Marshall, St. Louis, Mo.:

As a teacher of operative dentistry I was particularly interested in Dr. Johnson's paper, and I was delighted with the syllabus the doctor presented. I go a little farther back than he does. He began with the hygiene of the mouth. I begin with the sterilization of the instruments and the hygiene of the hands of the operator. I want to say also that I cannot agree with Dr. Johnson in the use of one term, and that is the word peridental. I agree with him when he says that the teacher must be saturated with his subject. It is the concentration of thought, born of enthusiasm, that makes us fit teachers; and that is the condition for one's mind to be in to present the subject properly to the student. I tried to use notes once thinking that I too might evade a stroke of paresis, but in referring to them I became entangled somewhat and as a consequence became so embarrassed that I suffered from a stroke of diaphoresis, which I assure our friend Hunt is infinitely worse than the other.

DR. G. V. BLACK, Chicago, Ill.:

Young men, when beginning their work in teaching operative dentistry or anything else, should write out what they are going to say very carefully; study it thoroughly, then make their notes and leave their writing at home. This will give them an opportunity to formulate what they want to say, get the proper words and the proper idea clothed in good language so that when they appear before their class they will make a good impression and gain the confidence of the students. Of course, some men read with such facility that they teach almost as well from the paper as without it. Possibly some men will do better but not for long. Very soon they should throw away their paper and depend entirely upon formulating the thing before they go to the classroom. Certainly notes should be made even by the older men among us; the headings at least.

I certainly should not undertake to teach anatomy in a course of teaching in operative dentistry. That belongs to another chair. The anatomy of the teeth and the various parts of the mouth should be given by the anatomist. Neither should I undertake to teach general pathology. Operative dentistry, as we know it to-day, deals with caries and its treatment, and the pathology of caries stands by itself. Whenever we touch a dental pulp we are into something else.

We divide operative dentistry, as it is generally known, into technical procedures in operative dentistry, pathology of caries and operative dentistry. I begin to teach operative dentistry after the student knows how to fill teeth. The filling of a tooth is a mere mechanical operation, and has nothing to do, except as a mechanical procedure, with the arrest of decay. What we want to teach in operative dentistry is the arrest of decay, the conditions under which it may be stopped there and then, if that is practicable, or what is best to do when that is impracticable. That is operative dentistry. When we come to the removal of pulps, the treatment of the soft tissues in connection with the teeth, the peridental membrane, then we are in another field of pathology.

It is pathology and therapeutics that we are dealing with then, and it is distinct and apart from operative dentistry. It is too much, gentlemen, to attempt to combine these chairs of pathology and operative dentistry. Of course, we may teach as a technical procedure the filling of roots of teeth, and all that; dealing with the subject in the light of mechanical procedures, purely technical, but we must remember that they are only the technical procedures of operative dentistry and not operative dentistry itself. When we come to deal with operative dentistry, we are dealing with conditions and restorative processes, the relief of distress. The technical procedures are simply a means and are taught as mechanical principles. How we shall lay the margin of a filling to gain the best results comes afterward. Here we are dealing with conditions; we are studying the pathology of decay and laying our plans for its arrest; and it is in this higher sense that we should teach operative dentistry.

Dr. D. R. Stubblefield, Nashville, Tenn.:

I wish to commend the paper that I have read and that I have enjoyed hearing read, simply because it occurs to me that it is almost ideal in its singleness of aim. If there is anything in the world that I admire it is that ability to see the object aimed at and to allow nothing extrinsic to deter your attention until you have reached the goal. Dr. Johnson's resume of his methods of teaching is one built upon such a definite purpose; therefore, it is not diffiuclt for me to imagine him carrying these things in his mind. He does not have to hesitate; there is a straight blazed path and when he sets his feet in that, each part suggests that which is to follow. It is logical; it is single; it is definite; it is intelligible. So that, without being a critical man from the teaching standpoint, I must congratulate myself on having heard on exposition of a teacher's method that is ideal to me.

I attempt to do all this in my own work. I first mature my subject at home, and if I find that I cannot succeed in grasping a clearly defined conception of it, I feel that I am uncertain and unreliable, and I never cease until I have it definitely before me. Then I do not want any notes. I have a message; I have a conviction, and it is not difficult to get the thing which carries it and brings you to the end.

With reference to note-taking: I think that the practice of note-taking, especially in the early stages of our teaching, is necessary. It is done merely to keep the untrained mind in the harness, as it were. You must have a message to convey, and to do that these captional headings are sufficient. It is wrong to attempt to pile it all into a manuscript, for if an obliteration of the definite path occurs, then you are off your feet and are in a rather deplorable condition. A manuscript is always a non-conductor between the reader and his audience. But when the manuscript is used only as a captional heading, whether fully written out or not, it becomes a sign-board directing you along the course you are to travel. We must train ourselves in that direction. Commence to make the briefest outline that will carry you along the road, and base it upon a well-defined conception of the object aimed at. Then, and then only, can we hope to succeed as teachers in any department of dentistry.

What Dr. Johnson presented to us to-day is logical, because he imagines himself operating on a tangible subject, and the students recognize his reasoning as well as the wisdom of his remarks, and, of course, they gladly follow him.

DR. GEO. E. HUNT, Indianapolis, Ind.:

I should be pleased to have either of the three gentlemen who cannot teach operative dentistry come to our college and I will try to do something for them, and yet I have my notes before me. I do not read them, and I said so very distinctly, but I have them to refer to in case of necessity. I rewrite these notes once every two years. I can remember them better when I do that. I would be very glad to hold a party in Indianapolis, and I will give any of the gentlemen a few points in regard to teaching operative dentistry.

DR. W. E. GRANT, Louisville, Ky.:

I want to commend Dr. Johnson's paper very heartily. I have listened to the discussions so far, and from my standpoint it seems to me that the criticism of not covering enough is not justifiable. My observation in looking over the question of operative dentistry, and what the various teachers are trying to cover in that department, is that the average professor of operative dentistry, devotes more time to subjects that are foreign to operative dentistry than he does to the subject itself. This thing of devoting two or three months to anatomy, and the same amount of time to pathology and only about six weeks to operative dentistry is a great mistake and overlapping too much on other teachers.

Dr. J. D. Patterson, Kansas City, Mo.:

I cannot appreciate what is the difference between operative dentistry and operative dentistry. A great many seem to be able to appreciate that difference but I am not of that number. So long as the fact remains that in actual practice the great majority of operations are in conjunction with pathological conditions, it is difficult to see just how operative procedures, and operative procedures combined with pathological conditions can be divorced so readily in teaching. It is well to divorce them if that is possible, on account of the time that is necessary to cover them both, but how this can be done is a puzzle to me. Therefore, operative procedures must perforce take into consideration pathological conditions and must be taught together.

I do not believe that in teaching operative procedures the professor should also teach the anatomy of the teeth. It seems to me that this should be taught entirely separate.

What I want to say more particularly is what Dr. Johnson said so well in his admirable paper in regard to the practical demonstration of operative procedures. I am a teacher of pathology, but not like Dr. Barrett who teaches nothing about instrumentation. When it comes to the treatment of pathological conditions, then we should practice instrumentation upon a dummy or upon a student, and it is a method that teaches my students far more than I can didactically. This is especially true when we consider the subject of cleansing of the teeth, and the treatment of conditions arising from calcic deposits. That is something that cannot possibly be taught didactically. I am extremely fortunate to have a set of teeth I picked up in the dissecting room, badly affected with pyorrhœa in its various stages. I had those jaws prepared for my own use and with a student in the chair and the jaws beside me, I proceed with the proper instruments, showing the position of the operator, the exact sweep of the instrument, and the proper instrument to be used.

I have done this because I found after teaching students for two or three years in regard to this important operation of cleaning the teeth in all stages of diseases, that when I go into the infirmary I see the students' utter incapacity, and it is wrong to expect anything else if we teach this most important subject by didactic work alone. It must be demonstrated practically and I have thus taught some men in my school to be expert operators in the treatment of pyorrhœa alveolaris.

Dr Johnson (closing the discussion):

First, I wish to take you back to the title of my paper. It ran something like this: "The systematic arrangement of lectures on operative dentistry." It was not intended to include all the things taught in operative dentistry. Neither did it pretend to draw a line between the different subjects taught in every college. There should be a distinct understanding between the teachers of different chairs so that the subjects may be in perfect harmony. It is impossible to draw a sharp line of distinction between different subjects and apply it to every college. It would not work well. When Dr. Hunt spoke of all the things he taught in his college I said to myself, as I looked over at Dr. Barrett, that Dr. Hunt is evidently not teaching operative dentistry in the same institution in which Dr. Barrett is teaching pathology. And that proved true.

As to writing out lectures: I admit the truth of Dr. Hunt's argument that it is an excellent way of learning a subject, and in my early days of teaching I wrote out all my lectures, but I assure you that after the first lecture I delivered to my class I never attempted to read a lecture afterward. During recent years I have not been writing out the lectures at all.

TO WHAT EXTENT AND IN WHAT MANNER SHOULD DENTAL STUDENTS BE TAUGHT EMBRYOLOGY?

By I. N. Broomell, D.D.S., Philadelphia, Pa.

The manner of teaching this subject to the dental student of the present day should not differ materially from that used in a medical course. It should be confined as much as possible to the human embryo. Perhaps one of the most important considerations in the study of embryology is that of a positive method of determining age, or at least to very nearly approximate this.

Information regarding the early development of the human embryo is somewhat meager and uncertain, but when this process has progressed to such a degree that the common buccal cavity is recognizable, the study of oral and dental embryology may be pursued with considerable certainty. The age of the embryo previous to this time is not therefore a matter of importance, but after this period it should be one of the first considerations. In the human embryo the age may be determined by measurement, by weight, by the appearance of certain well-defined anatomical parts, and by the disappearance of certain transitory membranes and appendages. That the appearance and growth of any organ or region of the body may be fully understood, the student should first become familiar with general embryology from its very inception, this applying with equal force to the dental as well as the medical student. Create a substantial foundation, therefore, by devoting two or three hours to the careful consideration of such subjects as fertilization, segmentation, and the germinal membrane or blastoderm.

The three germ layers of which the blastoderm is made up should be separately and collectively considered, the process of cell multiplication and cell differentiation carefully explained, and following this the derivatives of the germ layers should be taken up and completely mastered before further progress is made. In this connection the hen's egg serves by far the best purpose, as by its use the early stages above referred to, and especially the blastodermic period, can be most satisfactorily studied and apprehended. Perhaps after this the general subject should be continued in regard to the various foldings which occur, leading to the differentiation of the embryo from the fetal appendages, and the formation of the body wall and digestive tract. The study should then be carried forward to the evolution of the face and mouth or buccal cavity, and it is here that true dental or oral embryology begins. It is not now sufficient to be content with research which instructs students in regard to the teeth alone, but all parts of the oral cavity, its walls, its bony framework and its important glands should have careful consideration. This part of the work should undoubtedly be confined to the human embryo, carefully prepared sections from two or three of these being sufficient to cover the ground for use in class demonstrations, to which it should be confined. Before making sections, or using those which have already been prepared (the latter is the most practical way), the embryonic face should be macroscopically studied. During the second month the maxillary processes and the mandibular arches are advanced to such an extent that their purpose may be easily explained and readily understood, and if additional embryos, say, one at eight weeks and another at twelve weeks, are next examined, the student could not fail to recognize the manner of the formation of the mouth. After thus carefully progressing with the idea of becoming acquainted with the growth of the mouth in general, the special work of dental embryology may be taken up, this process being so similar in all mammalia that it is not required, nor is it possible to employ human embryo for the purpose. It is not possible because to pursue it very many sections are required, in the production of which much more material is needed than could be obtained from the human subjects.

After considerable experimentation, the writer has come to the conclusion that sheep embryo serve the best purpose. They are readily obtainable, the elongated form of the maxilla is especially convenient, and while it is difficult to understand, the cells appear to be somewhat more strongly differentiated in this than in some other of the other lower animals. Unborn lambs can be obtained from the slaughter houses almost for the asking, and by measurement their approximate ages may be arrived at. Valuable as microscopic sections may be in this particular line of work, they are scarcely more so than carefully conducted macroscopic dissections.

Provide each student with one lateral half of a sheep's mandible. Instruct them to remove from this all the soft structures except the mucous membrane and underlying periosteum. Subject this to some hardening solution for twenty-four to thirty-six hours and they are ready for dissection. Do this by making an incision along the base of the bone, cutting entirely through the mucous membrane and periosteum. Continue the work by stripping the bone first from the facial and then from the lingual surface until the margins of the crypts are reached. Up to this point the operation will be simple enough, but the removal of the follicles from their bony encasements will require special and painstaking care. In order to accomplish this, it is imperative that the periosteum be included and lifted in the dissection. By careful manipulation which may include the removal of small portions of the bony cover to the underlying crypts, the periosteum may be detached from this and the follicles removed. This may in turn be dissected, and a macroscopic study of the contents be made. No other procedure will give the students such a clear idea of the sacular stage of tooth development as the foregoing. By this method the student becomes familiar with the relationship which exists between the tooth germs, the surface epithelium, and the surrounding bony structure, and the preparation for section making may next be taken up, and the results more fully understood.

With this part of the work indelibly impressed upon the minds of the students, little is to be gained by making sections in the very early stages of buccal development, especially when this has been covered by the teachers' slides previously prepared. Lambs' heads varying in length from two to seven or eight inches include all of the important stages in the development of the teeth. The work of section making should be begun on the smallest size, and gradually continued until the maximum size is reached, allowing between each stage not more than a half inch in the length of the mandible. The following technic for the preparation of material is simple, but effectual.

First. Sever the mandible from the rest of the head, and remove all soft tissues excepting the mucous membrane. The smaller bones may be placed in a hardening solution without cutting, but those of larger size should be cut into pieces, say, about one inch in length. These are next hardened by placing them in a mixture of potassium bichromate two parts, sodium phosphate one part, and water one hundred parts (Muller's Fluid). This fluid should be used in large quantities, and renewed at the end of twelve hours, until twenty-four or thirty-six hours have elapsed, according to the thickness of the specimen. Remove them from this and wash in running water for twenty-four hours.

Second. Dehydrate by placing first in 50 per cent alcohol, which is gradually increased to 75 per cent and finally to pure alcohol.

Third. Any tissue that is not to be decalcified should next be placed in cedar oil for about twenty-four hours to make the tissue take up the paraffine or imbedding material. These are next infiltrated by placing in melted paraffine for twelve hours, the bath being changed at the end of this time, and repeated for a like time, after which the final imbedding may be done.

Fourth. Tissues to be decalcified are taken from the dehydrating bath above referred to, and placed in a decalcifying solution, 3 per cent nitric acid, and 70 per cent alcohol. When decalcification is completed they are washed for twenty-four hours in running water, and again dehydrated. Decalcified specimens are in like manner transferred to paraffine bath, after which they are imbedded.

Fifth. They are now ready for section making. A rapidly-moving micratome will give best results in the way of forming ribbons in section making. Sections of these ribbons may be transferred to the glass slide which has previously been prepared, by giving it a thin coat of Miles albumen, to make the section adhere. A few drops of water are placed over them, and the slide held over a clean Bunsen burner a sufficient length of time to make the sections flatten out. At this stage of the work it is very much better to examine with a low power to see what the sections contain. If they are not such as are desired, they may be discarded, and others placed in position and examined in the same way. The slides are next placed in a moderate oven over night, with sufficient heat only to more firmly attach them to the glass slide without melting the paraffine investment.

Sixth. After removal from the oven, place in xylol to dissolve the paraffine, which will require from five to ten minutes. Take from the xylol, run pure alcohol over the sections, place in a bath of weak iodine and alcohol, gradually change to alcohol with still less iodine, and finally to pure alcohol, the iodine bath removing the crystal of corrosive sublimate. After the paraffine has thus been removed, the specimen must not for a moment become dry.

The most satisfactory staining solution, and at the same time the most easily managed, is that of carmine and picric acid. First place the slide and specimen in the carmine until the tissue is quite red, say, about one-half hour. Remove from this, wash thoroughly with alcohol, and next place in picric acid for a few moments only, then wash again with alcohol, and next cover the specimen with creosote to make it take up the Canada balsam, if this is used as a mounting medium. Pour off the surplus creosote and complete the operation by the addition of balsam and the cover glass.

Many other stains of course may be used, but little additional information is gained by so doing, and it only complicates what would otherwise be a simple operation.

DISCUSSION.

Dr. Whitslar:

The author of this paper indicates that the manner of teaching this subject should not differ materially from that used in a medical college. The difference is in most cases the amount of embryology taught. It is not necessary to develop the whole anatomy in a dental course, but a general idea of the development of the various tissues is worthy of the time and effort. This is particularly true of the epithelial and connective tissue groups, although the nervous and muscular groups are quite necessary to consider in the relations of the evolution of the teeth, jaws, and face.

At this point I desire to make this general observation, that the teaching of embryology or any subject should be simple and consistent with the advancement of students. It is therefore expedient that we raise the standards of requirements of entrance to colleges so that subjects taught can be elaborated with the assurance that students will comprehend them. The versatility of the teacher, as well as his ingenuity, is often taxed in the presentation of the subject of embryology. The teaching of anatomy to make it interesting depends upon the teacher. Professor Broomell seems, however, to have solved the problem to a great extent, and met the needs of his classes and himself as a teacher, by providing a suitable and admirable text-book. If we refer to the text and illustrations of this book we can easily comprehend the value of the macroscopic study he outlines in his paper. Actual specimens demonstrated to the class in small sections give instruction that is not easily forgotten, and it also leads to a greater interest in microscopic work. While the laboratory work in general histology should precede the study of embryology, it is necessary to remind the students of the early development of the cell, its maturation and fertilization, then especially segmentation. We now elaborate the epiblast, mesoblast, and hypoblast. If these primitive layers and a general conception of their derivatives is fixed firmly, a basis for evolving the tissues of a tooth is established. For instance, we indicate that the enamel of a tooth is a derivative of the epiblast only. The epiblast lines the cavity of the mouth and becomes the Malphighian layer of the mucous membrane and from this the enamel organ is formed, which by means of the microscope and stereopticon is illustrated a wonderful picture. The processes of segmentation are in reality difficult to pursue, especially of the holoblastic type of segmentation, because of the scarcity of natural material, but the meroblastic type is easily studied with the hen's egg. I have often wished that we could spend some time, if the time allowed, to study successively the stages of the primal stages of the developing chick. This could be accomplished with the hen's egg during incubation. It would tend to advance microscopic work investigation.

Let me say, that I believe there is no such training in our curriculum preparatory to the dental work proper as microscopy. It trains the eye to see, the mind to think connectedly, and the hands to execute. Microscopic work should have a large place in the curriculum.

Now, Professor Broomell has indicated that the study of embryology should deal with the tooth development as well as the structures of the mouth walls. With this development we must remember that while an embryo is in an ordinary sense the vitalized germ before it reaches its distinctive form, in reality the term embryology is employed to cover the anatomy and physiology of the organism during the whole period embraced between the time of impregnation of the ovum and the complete development it attains in the adult. This, you will perceive, is undoubtedly true, especially in regard to the development of the teeth. Therefore, this course of study should include all the factors pertaining to the eruption of the teeth. This follows naturally after calcification of the teeth. Professor Pierce's chart of the calcification and decalcification of the teeth is of great value, and Dr. Broomell's illustrations of individual teeth upon the same subject are fine.

Dr. Broomell has kindly given us his methods of preparation of specimens as well as his enthusiasm, so it is safe to say that every member of this body will carry home the conviction that the course in embryology must have a larger amount of time and consideration given to it in the curriculum.

J. J. Mackenzie, M.B., Toronto, Canada:

Dr. Broomell's presentation of this important subject has interested me exceedingly, and I regret very much that I cannot be present personally to congratulate him upon it.

There is little doubt in the minds of teachers nowadays as to the importance of a knowledge of embryology for the student of dentistry or medicine. It should form the groundwork for the intelligent appreciation of the facts of both minute and gross anatomy, and our understanding of pathological processes will be the clearer and broader the more we recognize the influence of embryological factors.

Dr. Broomell's position in regard to the necessity of emphasizing the macroscopic side of the teaching I thoroughly agree with: I believe that it is the experience of every teacher of histology and embryology that he insists more and more upon the study of objects with the naked eye and the lowest powers of the microscope, and if every student were made to provide himself with a good, simple pocket lens, or if each microscope box were provided with one as a part of its equipment, it would be found a very useful adjunct in teaching.

I take it that the author of the paper would not advocate the establishment of a course in embryology distinct from the department of microscopic anatomy, and in this I would agree with him; I personally have always found that the best introduction to the study of histology was a few lectures and demonstrations in general embryology, but there is no doubt that these few introductory lectures are not enough to devote to such an important subject, and the practical question which dental teachers have to face is, how much time can be spared from the already somewhat overloaded curriculum? For the solution of this difficulty I do not presume to offer any suggestions, as I feel that that should be left in the hands of those whose duty it is to arrange the whole curriculum of study. We who are engaged in the teaching of the preliminary subjects of the course are apt to find our departments looming too large in the field of our vision, and no doubt in the struggle after a more scientific groundwork of instruction in medicine and dentistry, it was well that this should be so, but now that this object has been attained, our duty is simply to point out the importance of the subject of embryology, and we may safely leave it to the combined good sense of the faculties to see that it receives its just recognition. I am, perhaps, dwelling a little longer than I should on this aspect of the question, but I feel very strongly that in a great many medical schools of this country we have an example of the way in which one subdivision of a subject has been developed to the detriment of the whole subject in the way in which the teaching of bacteriology has tended to crowd the teaching of general pathology.

I should advocate, therefore, the extension of the time devoted to the course in histology so that the embryological instruction could be included in it and possibly include in the course in comparative anatomy a short course in comparative embryology.

To return to the discussion of Dr. Broomell's paper, it seems to me that the question of the importance of age determination is somewhat overestimated by him; aside from its general developmental significance, I should not be inclined to dwell specially upon it.

In regard to his position in insisting upon a thorough study of the development of the face, there can be no two opinions: its bearing upon oral pathology, one might say, is evident on the face of it. In my own teaching of the development of the tooth, I have found Rose's models of the very greatest assistance, and it seems to me if we had the time to allow students to do a little of the "platten modelirung" for themselves, it would emphasize the value of the results of Rose's work for our knowledge of the developing tooth. It is possible that this might be accomplished by demonstrations to the class from good series of human embryos, followed by the distribution of mimeograph reproductions of drawings of the portions of sections to be modeled. By giving to groups of students definite portions of the face to model or definite parts of the mouth cavity, one could engage the whole class in the work. Instead of wax, modeling clay worked to a proper consistency and rolled to a thickness corresponding with the magnification of the drawings could be used.

It is not, perhaps, wise to criticize methods as outlined in such a paper as Dr. Broomell's, because the methods which give the best results in the hands of a given worker are those with which he is most familiar, but I would like to express my preference for the combination of Formol with the Müller's over the pure Muller as a fixative or a combination of sublimate with potassium bichromate, or even the ordinary aqueous 5 per cent to 10 per cent Formol. For distributing individual sections to the class, I prefer celloidin imbedding, since cut sections can be so easily stored, and there is no danger of destruction of the section if they are given to the class to stain and mount.

As a stain I prefer Haematoxylin, and in that modification known as Ehrlich's, staining fairly deeply and using the van Giesen method of counterstaining with picric acid and acid fuchsin; this method of staining I feel convinced is by far the best one we have for routine work, either in normal or pathological histology, giving, as it does, such a beautiful differentiation of all the elements of the section; but, as I suggested above, the good workman rises superior to his tools, and we have only to consider the truly wonderful results achieved in the old days of the simple hand razor or double knife to be again reminded that "it is the man behind the gun that does the work."

In closing, I wish again to offer my heartiest congratulations to the author of the paper for the able manner in which he has presented the claims of embryology for a place in the curriculum.

Dr. F. B. Noyes, Chicago:

Mr. President—The first question in my mind is as to the position of this study in the dental curriculum. Certain it is that there is no more difficult study to teach than this. I am of the opinion that the place for the consideration of this subject is not to serve as an introduction to general histology, because in order to appreciate and understand embryology the student must have the ability to recognize the different tissues. The student is in need of all his knowledge of the appearance of the tissues in order to interpret what is presented to him. He needs all the training and microscopic interpretation he can get in his course. For that reason I believe that all the general histology should be given in the first year; the dental histology in the first part of the second, and embryology at the close of the second year. At that time he has a thorough knowledge of the tissues in general, the teeth in particular, and he is ready to take up a subject which leads him further than any other in the entire dental course. I mean by that that embryology is the broadest, the deepest and most far-reaching study of them all.

Dr. Broomell says that the manner of teaching this subject to dental students at the present time should not differ from that in force in the medical schools. I cannot agree with him in that regard. The physician is more particularly concerned with the nutritive processes, as we see them in the embryo, than the dentist The dental student is more especially interested in the manner of development of the individual as a record of the development of the type, and not with the nutritive processes of the embryo. I believe that we should discard all that we do not have to consider particularly in the dental course, such as the origin and growth of the various maternal membranes and other organs and structures which are developed for the nutrition of that parasitic creature during its parasitic stage. We are concerned with the development of the embryo itself and for that reason we can eliminate the most complicating part of the subject, that with which the medical student must be familiar.

The purely technical part of the paper calls for no discussion So far as I know the course in dental histology in most dental institutions is practically a study of sections of developing teeth. I believe that that is of comparatively little value to the dental student, because in order to interpret them properly he must have a knowledge of general embryology. I take it that it is obviously impossible for the dental student to spend enough time upon embryology to follow the subject through a full course. It can be only an outline, beginning with the segmentation of the ovum and the formation of the various germ layers; then the heart, enteric tract and the other organs.

What, in my judgment, is required is that the instructor be very familiar with the subject; that he be able to eliminate the complications and present in a clear and concise manner the history of development, and I believe that that can be done better in the lecture-room, with demonstrations in chalk, lantern slide and clay, than we could ever hope to do in the laboratory. I would modify that to this extent. If it were possible to obtain sufficient material for the students to carry out the dissections which the essayist has suggested, and the time of the course were unlimited, I would be ready to admit the value of laboratory work

The proper introduction to the study of embryology is a historical review of the development of our knowledge of the mechanism of cell life.

That opens before the student's mind the whole subject of heredity and transmission. It presents for his consideration an entirely new field, one that is extremely far-reaching in its effects and results. It leads to the definiteness of embryological development. The fact that the nucleus of the fertilized ovum controls the whole process, explains how it is that the enamel organ develops in the jaw; and the dental pulp develops under it. Not because the enamel organ makes the dental papilla develop, but because the material which controls the development of the dental papilla and the enamel organ cell has been sent there by the mechanism of cell division. That is the first idea which the student must have in the study of embryology; and then we must follow out the successive stages of development.

The best way to learn anything is to study it out for yourself, but at the same time this is also the slowest and most difficult method. I believe that a good teacher who knows his subject can give a clearer idea of development than the class could work out from original material in five times as much time. What the dental student wants is that clear idea of development without being obliged to go through all the work which would be required of him if we are going to make an original investigator out of him.

Just one word in regard to helps to teaching. I believe that there is no help to the teacher of embryology which can compare with the clay. Take a ball of clay and let it represent the ovum; then carry out the idea of segmentation on that ball of clay and you can show exactly how segmentation takes place; then you slowly develop the blastoderm, and from that go on to the modeling of the primitive groove and the primitive streak; the medullary plates; building them up bit by bit. Then take a knife and cut through that clay and project on the wall from lantern slides the cell structure of the blastoderm. In the same manner you may continue the building up of the embryo, showing the formation of the oral cavity, beginning with the development of the neural canal, the development of the brain vesicles; the formation of the face; the failure of union which causes cleft palate and all the other features of special interest to the dentist. It is in line with Dr. MacKenzie's statement that the wax models are of much use to him. In the technical procedures every man will have his own preferences.

Dr. H. B. Tileston, Louisville, Ky.:

I have been so busy filling the duties of the secretaryship that I have not had any opportunity to prepare any discussion on this subject. But, needless to say, I have been very much interested in Dr. Broomell's paper, and I believe that it is deserving of unstinted commendation. Embryology, although we must all admit its importance, has only a minor place in the minds of most dental teachers and also in the curricula of dental colleges. I have looked in vain in the catalogues of many institutions for even a mention of the fact that embryology is taught or that it is considered of sufficient importance to receive a place in the course of study. And, judging from the general exodus to-night, when this subject came up for discussion, I believe I am justified in saying that it is considered something entirely foreign to the teaching of dentistry. It is an interesting study to take up, and it can be made exceedingly interesting to the class by any one who is an investigator. I at one time was a teacher of embryology, although I never made any original investigations, having neither the time nor the inclination to take up this work, as I know that every teacher of embryology should. Of course Dr. Broomell has made a study of this subject, and he is capable of teaching it in a manner which would be entirely impossible to the great majority of practicing dentists. The subject is taught in a very desultory and unsatisfactory manner in most of our colleges. In teaching it I have never been able to follow the subject as closely as if I had been doing original work, but I always did the best I could from what I could gather from the writings and investigations of others.

The course is not mentioned in the curricula of dental colleges unless it is included under the heading of histology, as was suggested by Dr. Noyes. I believe that this subject should have the consideration at the hands of the dental profession that it deserves, and I am sorry that at the present time it has not a definite place on the curriculum.

Dr. G. V. Black, Chicago:

Although I had the pleasure of hearing the paper, yet I unfortunately missed much of the discussion thus far. Embryology is a subject of vital importance; a subject that we cannot do without; a subject that we cannot teach in full. When I had dissected and examined the human embryo in all its stages, practically, I obtained one of the greatest works on that subject I have ever known, one of the greatest that has ever been written (it was in the German language), and I found 300 pages of closely set small type, nearly a thousand words to the page, which considered the first three days of the development of the embryo of the chick. After I had waded through all that and thought that I comprehended it fairly well, I said to myself, "We can never teach this subject in any dental school." It can only be taught by the specialist in embryology; and yet, shall we for that reason give up teaching something of it? By no means. Pick out those fundamental things, those things which are of real importance to the dentist, and teach them, not only didactically in the lecture-room, but in the laboratory as well. We ought to do the best we can under the circumstances. It is not necessary, nor is it worth our while, to give all there is on the subject of embryology, but let us teach at least those things a knowledge of which is necessary to a proper understanding of the mechanism of life. We should also teach those things which go to make up the formed elements of the tissues and their development; we should teach along the lines of dental embryology. This we can do with profit to the student without going into the whole subject of embryology. There are some things that he should know, and it is for these that the subject of embryology should be included among the subjects embraced in the dental curriculum. It is altogether too important a subject to be omitted entirely, and it should be taught by a man who is thoroughly competent.

Dr. Wm. C. Barrett, Buffalo, N. Y.:

I understand that the subject under discussion is the teaching of dental embryology and not the study of that science. I do not understand that in our dental colleges it is advisable, or even desirable, to take up original investigation, because if we should attempt it we must take the time for it from other studies, which are much more essential to the dental student than is embryology.

I have for a considerable number of years been teaching dental embryology, and I have never cut a section before the class, nor have I ever asked my students to mount one. I teach that which has already been demonstrated and do not believe it essential practically to prove every proposition advanced. They must accept some things for granted.

All life is not from the egg. Parthenogenesis is the development of the asexual life. In Karyokinesis I commence with the fecundation of the ovum, and carry them through its segmentation and gastrulation, the formation of the several blastodermic layers, the progressive metamorphosis that takes place in the development of the embryo, until I finally reach that stage in which we note the appearance of organs. Then I trace the buddings of the various external parts of the body, the formation of the visceral arches and clefts, gradually leading up to the first formation of the so-called primitive dental groove and the dipping down of the various layers for the formation of the dental follicle. I trace the dental follicle through its development, give its history, and by means of the lantern throw upon the screen the prepared sections, illustrating all the various stages of the growth of the dental follicle. All this can be done without giving out a single section. I believe that it is a waste of energy to give the dental student a course in laboratory embryology, for the time at our disposal will permit only the teaching of a general, yet succinct, idea of the whole subject, without going into a detailed study of it.

That we shall rob other studies which are of more importance to the practicing dentist than embryology of some of the time allotted to them, is radically wrong. I am very glad that we have men in our profession who are willing and who can make original investigations in this subject, but that is not for the mere tyro. I do not believe it either advisable or desirable to teach original investigations, nor even to pursue them in the presence of the student; not because it is undesirable knowledge, but because there is not time enough in which to do this work without taking it from other more important studies. The student should not be compelled to do original work in this subject, but he should have the benefit of such work when it is conducted by his teacher.

Dr. Geo. W. Cook, Chicago:

I want to ask a question. In listening to the discussion on this paper, it is apparent that nearly all are agreed that embryology is one of the essential things in our curriculum. Now, I would like to ask those gentlemen who have been teaching embryology and histology, how much time should be devoted to the teaching of those subjects? Of course, the work can be done only by one who is familiar with these subjects and who has classified them for the dental student. While, as Dr. Barrett says, it is not necessary to teach the dental student how to carry on original investigations, yet I believe it is necessary that he should have a working knowledge of the subject if it is of any value to him. Now, just how much time should be devoted to these studies, and would they crowd the other studies in the curriculum?

Dr. Wm. C. Barrett, Buffalo, N. Y.:

A considerable portion of that which has been sketched out here, and which I have heard mentioned as the study of dental embryology, belongs to embryological histology, and not to the development of the ovum. The organization of the tissues is a part of histology and not embryology, the latter more especially relating to the development of organs.

Dr. F. B. Noyes, Chicago:

My course in embryology occupies about six weeks at the end of the term; one lecture hour and two laboratory hours weekly.

Dr. Fred C. Zapffe, Chicago:

When I was first appointed professor of histology in the dental department of the University of Illinois, I was confronted with the problem of occupying one hour a week with a lecture on histology before a class who had full credit for this subject. The two-year term in histology was then just being inaugurated and it became necessary for me to fill in this time with something which would be of service to the dental student. It occurred to me that a course in embryology would be not only interesting but valuable in pointing out the method of growth and development of the mouth, teeth, jaws and accessory cavities and parts, and also to take up the embryologic causes for the existence of cleft palate.

hare-lip, and other deformities of the oral cavity. To my knowledge no other chair in the college was taking up this work, and I believed at that time that I was a pioneer in teaching embryology to the dental student.

I proceeded to outline my course of work in order to give what was essential to the dentist and yet to hold the interest of the class while I was leading up to that portion of the work. Embryology is essentially a laboratory study, and it is a study of a lifetime and not one of seven or eight months, of one hour a week in the lecture-room or a few hours a week in the laboratory. The peculiar nature of the work, the fact that it is a study in progression, prohibits its study on models, or charts, or even microscopic sections, unless they are serial sections. Again, embryology is a miscroscopic study, and the dental student has neither the time nor the training in microscopic work to go into it to any great extent. Even if it were possible to obtain animal embryos in sufficient quantity to supply each two or three students with a specimen, the rapidity of development in the animal embryo, the vast and important changes that take place in the space of a few hours, militate against the use of animal embryos in the study of embryology; at least, in the class-room or the laboratory of the college. So that when we come to look the ground over we are forced to the conclusion that the effectiveness of a course in embryology is dependent entirely on the ability of the teacher and his wisdom in the choice of such parts as will be of value to the future dentist.

The teacher of embryology should of necessity be thoroughly versed in histology, pathology and bacteriology, so that he can dwell with sufficient emphasis on the relative importance of each stage in the development of a tissue or organ. His knowledge of embryology should be in consonance with his training in the other branches. And, withal, he must avoid overwhelming the student with a mass of facts which take the form of a meaningless jumble. The teacher of embryology should also have some imaginative power; he must be able to depict with the pencil or chalk what he is describing in words; he must have clearly outlined in his own mind just every step of the development of the embryo; what precedes and what follows, so that he can give the student clear and concise information. Judging from the remarks of the preceding speakers, we all appreciate the difficulty of teaching embryology when it is given at the same time with other work which naturally distracts the mind of the student. A course in embryology, to be complete, should be taken up by itself, followed continuously and thoroughly. Inasmuch as this cannot be done in the dental school, nor in the medical, we must search for the best we can do.

As I am a medical man and not a dentist, I was somewhat at a loss at first to choose just what would be of most service to the dental student. But I managed to get started, and one thing naturally followed another. I devote the last four months, or nearly so, of the junior year, to the teaching of embryology. I give a lecture course, one hour a week, for fourteen weeks. I begin with the fertilization of the ovum and continue with its segmentation, the development of the blastodermic layers, the neural canal, after the formation of the primitive streak and groove. I do not go into the detail of the formation of the genito-urinary nor the respiratory or gastro-intestinal tracts, except in so far as would pertain to the head and neck. I put in all my time on the consideration of the development of the various parts and structures of the head and neck, and especially the oral cavity and its parts and accessory cavities; giving this portion in full with the view of impressing firmly on the mind of the student the reason for malformations. I can complete this course in just fourteen solid lecture hours, excluding the quizzes, and many times I fail to hear the bell and talk more than an hour.

As accessories to teaching this work, I use my hands, my imagination and a good deal of chalk. I draw everything as I describe it; representing it from every side and in all its phases, so that the student cannot but follow me. I use colored crayons and spare no effort to make the work clear. In this way I can follow out the successive stages of growth in one drawing, and I am firmly convinced that my students get more out of it in that way than they would from charts, models, or even a laboratory course. Clay is also an excellent adjunct, but I fear that the students become more interested in the manipulation of the clay than in what you are trying to represent.

HOW MUCH, HOW AND WHEN THE DENTAL STUDENT SHOULD STUDY ANATOMY.

By Leonard C. Borland, M.D., L.P., Chicago, Ill.

The question of "how much" anatomy the student of the dental profession should have taught him seems to be one that has agitated the minds of both the student and the teacher ever since I have been teaching this branch, for the past twelve years. In fact it seems to the author that the most important question for any instructor to decide is "how much" of his subject those under his tuition should have taught them. One cannot accept one's own conclusions as to the amount necessary, with justice to the student, without having first placed them upon the tribunal of the judgment of all other teachers of the same subject; next, all the other teachers connected with the same institution in the other departments, and, finally, must take into consideration the *ultimate needs* of the student himself. From investigation it would appear that there is the widest difference of opinion upon this subject. Many of the teachers in the other scientific and practical branches of dentistry have not the slightest conception of the amount of scientific teaching used as the foundation in medical colleges. Nor do they in many instances even know the amount of these branches taught in their own institution. With a view of obtaining information upon the question of "how much" anatomy should be taught from which to form a composite opinion, the writer has placed himself in communication with fifty institutions in the United States teaching dentistry. As a result of the first inquiry only seventeen replies were obtained. A second and a third communication were sent out, with a final result of receiving replies from thirty-nine of the fifty institutions. The field covered, the manner of teaching, and the time spent were so variable that it was impossible to compile accurate statistics, although a great deal of valuable information was thus obtained from which it is possible to draw some deductions. They have been carefully preserved for reference and will be published verbatim should the society elect. In addition to the consultation of our own schools in regard to the matter in hand, we have also consulted some of the most prominent teachers of the three professions, to wit: medicine, law and theology, in regard to it. Further, members of the commercial pursuits were asked. To sum up briefly, it seems to be the generally accepted opinion that the dentist should cover the entire field of the fundamental scientific branches in a general way, with special attention to the parts in and about his future field of operation. If the position is tenable that the doctor of dental surgery is a member of the medical profession, and his specialty the structures of the mouth, and that he is of the same professional standing as the doctor of medicine who is a specialist upon the eye, heart or skin, then it seems apparent that the medical specialist upon the eye, etc., is taught a great deal of the unnecessary fundamental, scientific branches of medicine. On the other hand, the dentist as compared with him does not receive nearly the same amount of scientific foundational knowledge. That is to say, that the specialist in medicine upon the eye or ear has certainly received a large amount of unnecessary, impractical and useless training upon the anatomy of parts remote from the field of his work, as well as all the other branches of medicine. It is obvious, also, that the student of dentistry, having made the selection of his specialty at the beginning, is in a position to cut out all this extraneous teaching and confine himself to that portion of scientific, fundamental study which will best fit him for his future work. To substantiate the conclusions before mentioned that a student should study the anatomy of the entire body in a general way I beg to put forth the following reasons: First, from a medical standpoint, there is no line of demarcation separating the oral cavity and its contents from the rest of the body. It is but a part of the entire organism and whatever influences any part of it will necessarily be expressed in the mouth and teeth. The abdominal contents must be included because they contain the alimentary tract, of which the mouth is the beginning. Diseases in other parts of that tract are often expressed in the mouth and teeth. Maladies begun in the mouth or teeth are transmitted and expressed in other parts of the system. The blood vessels which supply the mouth and the blood therein contained are but transitory in the pulp of the teeth and in the floor of the mouth. The corpuscle in the inferior dental artery can in sixteen seconds be in the plantar artery of the foot. A capsule filled with potassium iodide, covered with a coating only soluble in the stomach, where, the salt being liberated, will pass through the walls of the stomach, be taken up by the blood current, pass to the parotid gland, the salt selected out and secreted, passes into the mouth with the saliva. The starch test will show the presence in the saliva of iodine in forty minutes after being swallowed.

Carbolic acid injected into the gingival margin can be found present in the form of salicyluric acid in the urine in from forty to seventy-five minutes by Siever's ferric-chloride test. The nervous system of the teeth may, by reflex action, produce pain in the eyes, stomach, ears, or remote parts. Disturbances in other parts may produce pain in the mouth, or disturbances in the teeth. Impairment may be due to pathological conditions in the mouth or the teeth, or vice versa. Phlegmonous inflammation may extend from the temporal-maxillary lingual or facial veins to the internal jugular, thence to all parts of the body. General systemic diseases, as syphilis, tuberculosis, anthrax or malaria, etc., find their point of invasion in this region and transmission to other parts most remote, or, having been received in other parts, find expression in this part. Animals fed alternate months upon arsenic and mercury show a disposition of the chemicals in corresponding concentric rings in the long bones, which I presume is also true of their deposition on the teeth in a similar manner. Reasoning upon these facts the dentist would not be in a position to perform his full duty by his patient were he not able to recognize these conditions and treat or refer for treatment these lesions to the proper source from which they would find relief.

The administration of arsenic, carbolic acid or cocaine, anesthesia with ether or chloroform renders it imperative that he should know enough of physical diagnosis to ascertain that the condition of the heart is normal. I think that this knowledge is possible without rendering it necessary for him to go deeply into the differential diagnosis of the different heart lesions. That is to say, he should know the normal position and sounds of the heart, but need not know the difference between hyperthophy and dilatation, nor which one of the valves is affected. I believe the time is rapidly approaching when the dentist will be held responsible by the public should any untoward results take place after the administration of a local or general anesthetic, or the use of any of the toxic drugs, if it should be proven upon investigation that the patient had a pathological lesion that could have been recognized by an intelligent physical examination or an examination of the urine. Therefore, it is necessary for him to study the whole body in anatomy and dissection that he may distinguish the normal from the abnormal.

There seems to be an impression in the dental profession that the student of dentistry is spending far too much time in the study of anatomy, and far more than the medical student. In answer to this I beg to state that during the freshman year the medical student spends an average of 85 per cent of his time on the four fundamental studies of anatomy, physiology, chemistry, materia medica and therapeutics in comparison to only 30 per cent, the maximum time spent in the first year in our institutions, thus leaving a balance of 45 per cent to be devoted to his special study of dentistry.

As an additional argument for covering the entire field of anatomy in a general way, we may use a well-known practice in commerce, to wit: that of having an employe, who is to take charge of any special department in a factory or large commercial house, first to spend a short time in all of the various departments of that institution before entering upon a special field which he is to occupy in time. We might also cite the case of our brother profession, the law, wherein the young lawyer is required to get a good general knowledge of all branches of the profession before he takes unto himself a specialty. The fact that the profession of dentistry began as a trade and was practiced as such originally is no reason that certain members of the medical profession should insist that it must always remain so. Surgery, in ancient times, was not a part of the regular profession of medicine, but was relegated to quacks and charlatans for centuries, until its final development into a science entitled it to a position as a specialty of medicine. History repeats itself to-day in regard to the dental profession.

Is it not right to assume that *any art* having placed under it a sufficient scientific foundation to meet all the possible needs of that calling is entitled to a professional standing? Furthermore, is not it the right of the dentist to designate himself as "doctor" of dentistry, and be recognized as such by the public, based upon his knowledge of the scientific, fundamental branches of medicine, i. e., anatomy, physiology, chemistry, therapeutics and materia medica? Surely the cognomen "doctor" is not granted for expert mechanical ability.

It is based upon a knowledge of the science and not upon competency in the arts.

In Germany the profession of dentistry is divided into, first, "Zahn Arzt," or, literally translated, "tooth doctor," meaning a physician whose specialty is the teeth and the mouth. He has acquired the title of "doctor of medicine," and in addition spent the required time to become a specialist upon the teeth and mouth. It must, however, be noticed that, owing to the selective method which is pursued at the German university, if he has decided upon dentistry at the beginning of his course of study, he can select those studies which will be of the greatest benefit to him and only cover the others in a general way; *but he must cover them all.* Another class of graduates from technical schools receive their credentials as "Zahn Technicher," literally translated "tooth mechanic." Those holding the diploma of "Zahn Arzt" have naturally a true professional standing, and are permitted to use any drug or perform every operation allowed to any member of the medical profession. Those holding the latter are not permitted to use the term "doctor," nor any other professional title. In conclusion of this part of the subject I permit myself to draw the following conclusions: That the dental student should study and recite the entire human anatomy in a general way, with a special amount of time and study devoted to the mouth, antrum, pharynx, palate, nasal cavity, tongue, neck, brain, thoracic and abdominal cavity, upper extremity, lower extremity, genital and generative organs, gradually reducing the thoroughness of his studies on each of the parts in the order in which I have mentioned. It will be noticed that many of the departments of general anatomy have been left out as unnecessary to the dental student. For instance, perineum, articulation except the tempro-maxillary. Second conclusion, that it is very imperative that the institutions teaching the subject of anatomy to dental students should arrive at a uniform understanding as to how many hours of lectures, recitations and dissections shall be spent during the first, second and third years of their course of study, and that, having arrived at this conclusion, they shall demand from other departments of medicine (i. e., medical colleges) the standing which this will entitle them to In medical colleges of the highest standing the time spent in the dissecting room is 240 hours: 60 hours upon the head and neck, 60 hours upon the arm and upper extremities and thoracic cavity, 60 hours upon the abdominal cavity, and 60 hours upon the perineum and lower extremity. If any dental institution is spending, for example, 150 hours in what the medical college is spending 240, then we should receive fifteen twenty-fourths of full credit in that department, and that upon the completion of the balance of ninety hours' work, we are entitled, and not before, to full standing in this department by such of our students as wish to enter the medical college. As is now the case the institutions teaching dentistry are unjustly in many instances asking for full credit in anatomy; and, on the other hand, the medical colleges are refusing to give any credit at all. All this might be avoided by reaching and publishing a uniform standard.

In this connection I cannot do better than to quote the words of the president of the International Commission of Education, Dr. Truman W. Brophy, in an address delivered by him before that body in Stockholm at their last meeting: "A mechanical training of the best kind is essential to the dentist and must form the basis of his future work. I would, therefore, strongly urge you not to imitate the education of the medical student, but to continue on the lines which will train a dentist for his own profession from first to last, and to have a single purpose in view, and to endeavor to obtain a definite result. Do not try to make a medical man a dentist, but let a dentist start and finish as such.

"Can this education be carried on side by side with that of the medical man, is the question of practical importance. I would unhesitatingly answer, No. The anatomist may train either, but he cannot train both together without giving one much more than he requires and not paying enough attention to the other."

Dr. Brophy, in another part of his paper, comments upon the definition of dentistry in the Ninth Revised Edition of the Encyclopedia Britannica as follows: "A special department of medical science embracing the structure, function and therapeutics of the mouth and its continued organs, together with their surgical and prosthetic treatment."

He says: "The above definition is, no doubt, as complete as any yet formulated and published in the English language. It by no means, however, covers the subject, nor conveys to the mind the full scope of the duties of a dental practitioner. Dentistry requires a broader definition than that. Strictly speaking, medical science constitutes but a small part of the modern dental curriculum."

From the foregoing it seems evident that the graduate does not get too much anatomy. Indeed, in spite of considering the immense amount of technique he must compass, the writer is of the opinion that he does not get enough general regional anatomy in dental schools where they maintain a separate dissection room. On the other hand, in dental departments of universities where they receive their instruction in common with medical students it would appear that their course of study is too exacting upon parts far removed from the oral cavity, with no special work upon the palate, antrum, nares, tongue, pharynx, etc.

The generally accepted meaning of the word "professional" among the laity, aside from the dictionary meaning, is one who has taken a thorough course of study and training, fitting him for all of the possible exigencies of that calling, based upon all the sciences having any possible bearing or relation to it, by an institution legally chartered by the government for that specific purpose. That dentistry is worthy of a professional standing, according to the foregoing standard, is not for a moment doubted by anyone who is familiar with the dental curriculum.

As to how the dentist should study anatomy, taking into consideration the fact of the immense amount of technical and special education that he must receive, and that his time is, therefore, exceedingly limited in which he must get his scientific foundation; it is, therefore, necessary to use every possible known means of facilitating his study.

The object of the teacher of anatomy in a dental college should be to give the student the largest amount of the most practical knowledge with the least expenditure of energy and time on the part of the pupil. It has, therefore, been my chief aim in the twelve years that I have been engaged in this work to use all of the known means, and to endeavor to find newer, better methods of teaching anatomy. With that end in view I first advocated the modeling of bones, muscles, arteries and nerves as a means of teaching, and carried it into practice ten years ago.

At the time I did this I was not aware, nor am I yet aware, that this method had been used previously. .

HOW TO STUDY ANATOMY.

Didactic or lecturing upon descriptive anatomy is a waste of time as a general thing, and is being gradually done away with. The only thing that the lecturer on anatomy impresses his hearers with is the fact that it has been possible for him to have learned and repeated it, and also to teach the pronunciation of words. The bringing of a cadaver before the class is almost of no value to any larger number than can come near enough to see the structures that have been dissected, i. e., the distance at which one can read fine print.

Didactic teaching on any subject is only of value where it is necessary to show the manner in which conclusions are reached or comparisons made, or the giving of general directions as to methods to be pursued immediately, i. e., to teach the student how to study, what to learn, how to reason and how to draw conclusions. The taking of notes by the student is to a large extent a waste of time, for few can write and listen at the same time. The notes printed in the text book are better than any that he can take. Millions of reams of notes have been scribbled which I am sure are never again read.

The recitation method is more valuable, but it also has the disadvantage that while one student may recite the rest of the class may be dreaming about something else. Its main value is to ascertain that the student knows the subject that has been assigned in the lesson. The method of teaching par excellence is the manual or kindergarten method, in which all students are doing the same thing at the same time, to accomplish which each must know the subject and keep his mind on it all the time. In this method all the avenues of gaining knowledge are in use, viz.: touch, hearing, sight and comparison.

Taking into consideration the foregoing facts, I have endeavored to devise a system of teaching for the most difficult of all technical subjects, anatomy. The method is described as follows:

Osteology is taught by giving each member of the class the bone under consideration, together with two pounds of artist's modeling compound, obtainable at any artist's material supply house for about fifteen cents a pound, or common clay, such as is used in the manufacture of bricks. If used in the class room, the dough-moulding board of the housewife (cost about twelve cents each), upon which may be held Gray's anatomy, bone and compound while the student models; or in dental colleges the prosthetic laboratory room benches may be brought into requisition. The instructor may pass behind the student while modeling, and, as soon as modeled correctly, hear his recitation upon the same directly from the bone and the model. By returning this bone the next one is given him, and so on. I used this and advocated it as a means of class teaching in 1892. It is now in use in many of the larger universities throughout the United States. I would be pleased to hear if this method has been used before I devised it.

Myology is best taught by having the student model the muscles under consideration upon a skeleton, stiffly wired together for the purpose, as shown in my exhibit No. 1.

The modeling compound I devised for the purpose and perfected, after trying over 200 substances, which would meet with the twelve necessary requisites: 1, easily obtainable; 2, cheap; 3, of a consistency of muscle; 4, plastic; 5, color; 6, non-decomposible; 7, would not "wilt"; 8, would gradually set or become hard; 9, would adhere at the point of attachment and insertion, but not adhere to the other muscle; 10, not soil hands; 11, tenacious, so as to be drawn out; 12, not crumble. The formula for the modeling compound is: To thirteen ounces of water add one teaspoonful of carbolic acid, bring to a boil; ten grains of carmine, and gradually stir in one pound of rye flour; when mixed remove from the fire and knead in ten drops of oil of cloves.

Arteries, veins and nerves may be added to this model by means of No. 20 telephone wire in red, blue and yellow colors, obtainable at electric supply houses.

Ligaments may be modeled perfectly by dipping absorbent cotton in glue and pasting them on the bones.

The muscle-modeling compound forms an excellent substance for modeling the brain, by which it is possible to give a better idea of the relations of the various parts of the brain than by any other means I have ever tried.

After having pursued the foregoing methods the student is ready to begin the actual dissections of the human body. Owing to the difficulty of obtaining material in many locations, some colleges are obliged to dispense with the dissections of the human body. In that case some of the lower animals may be used to great advantage, as the dog, cat and pig, or the modeling method described may be used.

DISSECTING.

It is of advantage to apportion out the work of dissection into a definite number of regions or parts to be dissected simultaneously by the largest number of students possible. In this manner they will have the advantage of seeing many times the structure under dissection. It is also desirable to have each make a drawing of the parts to be dissected before entering the room. I have prepared a set of thirty outlines, embracing the entire human body, in which the student may fill in the muscles with pink, color the arteries red, veins blue and nerves yellow, with either water color or pencil or colored crayon.

As far as possible a dotted enclosure is left upon each structure, wherein the student is to fill in the name thereof. Drawings of each region occupy the student's time from one to four hours each. Nearly as much knowledge can be gained by filling in and coloring one of these outlines, which only occupies his time for fifteen to thirty minutes, as by making an entire drawing. The portioning out of the day's work and giving a list of the structures to be found in that region, together with some brief instructions and cautions in its dissection, have also been printed upon the outline accompanying the system. After the student has dissected the region in question he should be quizzed, his paper collected and a mark given averaging his drawing and dissection. This method has the additional advantage of making each student find each structure in the region and cover the entire field. It also does away with the slashing and cutting away of material and throwing it away, which is frequently the case where no attempt is made to check the student's work in detail. It is of satisfaction to the student to know how he stands on each day's work, and is usually a stimulant for him to do good work.

WHEN SHOULD THE STUDENT STUDY ANATOMY?

It is advisable to devote during the first half of the freshman year, or three months, four hours to the recitation and modeling of bones and articulation. During the second half of three months, four hours each week to the modeling and recitation of muscles. During the first three months of the second year, to the modeling of arteries, veins or lymphatics, two hours once each week. During the second half of the second year, or three months, to the brain and nervous system, four hours once each week. The dissecting should be done during the first month of the first, second and third years, four hours each day, five days each week. First year upon the abdominal cavity and lower extremity; second year upon the thoracic cavity and upper extremity; third year, head and neck. During the time the student is engaged in the dissecting room he should not be permitted to do any work in the dental infirmary. It is advisable to have this work gone over as expeditiously as possible, owing to the perishable nature of the material. Also to have it out of the way so that he may have his hands in condition to do work in the mouth for the other five months of the three years.

EXHIBITS.

1—Bones of the vertebral column modeled by freshman class during the first six lessons.

The object of this exhibit is to show the progress made during that short period.

2.—Seventeen hundred drawings of the *ten regions* covered by *175 members* of the *freshmen* during one minor (sixty hours) in dissecting room.

3.—Thirty-six hundred drawings of the twenty regions of the upper extremity, head, neck and thorax and contents, showing drawings of the *special regions* covered by dental students, not usually included in the course of the medical students, were made by 180 members of the junior class during one major (120 hours), in five weeks, twenty-four hours per week. Some students can accomplish this in eighty hours.

These drawings and demonstrations are intended to indicate the *special fields covered*. They are suspended above the dissecting table while the work is being done, and are used for reference by the students. The making of these drawings prior to the doing of the work forces the student to spend some study on the dissecting before entering the room. It relieves the monotony of studying the text and reciting like a parrot, and helps to retain the knowledge and teaches the relations of the parts. Each student receives a mark on the drawing, one on his dissection, and a third on his recitation. These three are averaged together and given as a final mark for this region. It seems to be particularly satisfactory to the student to feel that he has accomplished this much and has it behind him. No final examinations are held for the reasons previously stated.

PRACTICAL DEMONSTRATION NO. 1.

The modeling of bones with plastic compound in the manner pursued by the students, showing compound, modeling tools, board, etc.

PRACTICAL DEMONSTRATION NO. 2.

The modeling of muscles upon the skeleton.

PRACTICAL DEMONSTRATION NO. 3.

Modeling of arteries.

PRACTICAL DEMONSTRATION NO. 4.

Modeling of nerves, brain, etc.

DISCUSSION.

Dr. F. D. Weisse, New York:

The work of Dr. Borland in schematic demonstrative anatomy is most unique and original in all its details, and stamps him as possessing an artistic sense possessed by few, and makes the possessor a born teacher who loves his work and enjoys dispensing the fruits of his gift.

In my experience of all professors in medical and dental institutions, I have met but one other man who possessed the peculiar endowments of Dr. Borland. That was Prof. Gilman Thompson, formerly professor of physiology in the Medical Department of the University of the City of New York; now Professor of Practice of Medicine in the Medical School of Cornell University. His work was in models, illustrating physiological phenomena, which are still extant, they being now obtainable from Ward of Rochester, New York.

I am surprised at the drawing capabilities of Dr. Borland's students, as shown by the reams of drawings exhibited. These drawings are unmistakably great aids to the acquirement and fixation by students of a knowledge of the parts which they are to recognize in their dissections. But I had no conception that our students possessed such an universal ability to draw. I always advise every student to take up free-hand drawing as one of the studies of his preliminary education, because so many students find difficulty in drawing the objects on the slides in the histological and bacteriological courses. The specimens of modeling of bones are revelations of the possibilities of endowing the "Dry Bones" of past anatomy with interest and life. The muscle modeling and attachments and the vessel and nerve inclusions are most ingenious, gross reproductions of nature, well calculated to lead the student to a thorough knowledge of the subject. I would commend most highly his dissecting room methods of having all students dissect the same part at the same time. Also having a drawing of each section suspended over the table while the work is being done. With regard to the value of recitations on anatomy, it is a lifeless—to quote the essayist's words—"Expenditure of energy and time on the part of the pupil," as compared with results obtained by time spent with other methods. In brief, I have naught but commendation of this method of schematic demonstrative anatomy, and would tender my congratulations to its originator on the possession of a gift which combines the deft of both sculptor and artist. I would especially emphasize the thought of the essayist by repeating it that we may all remember it: "The object of the teacher of anatomy—the same is true of the teacher of any department of the curriculum—should be to give the student the largest amount of the most practical knowledge with the least expenditure of energy and time on the part of the pupil." As the subject of this essay is "Teaching of Dental Anatomy to Dental Students," I think it may interest the represenatives of dental institutions and a few teachers of dental anatomy in dental institutions that are present at this meeting, to call attention to how general anatomy is taught the dental student at the New York College of Dentistry.

We have always held with the author of the paper that the dental student should be taught the anatomy of the entire body. We divide the subject between the department of anatomy proper, and the department of physiology. The department of anatomy, developing the regional anatomy, locating all organs, including the viscera; while the department of physiology develops the special anatomy of the viscera, the chair being called "Physiology, Viscerial Anatomy, and Histology."

Experience of the past thirty odd years has proven this division of the work as most advantageous to the student in his better acquirement of both the anatomy and physiology of the organs, the anatomy of the organ directly preceding its physiology. This division also affords the professor of anatomy more time to develop the regional relations of the organs of the several subregions of the body. Anatomy must be taught in one of three ways: first, from the cadaver; second, by every possible schematic aid that may be devised, for facilitating the student in finding and recognizing the several parts as he dissects; third, by didactic lectures, with selected sequential reproductions of nature, so enlarged as to be instantly realized by all the auditors before the lecturer. Much has been said of the uselessness of didactic lecture teaching as compared with dissecting room and laboratory work. Where the question of technic is the knowledge to be acquired, this may be the case in a large degree, but there is a vitality that is imparted in the dispensing of knowledge by the human voice—when it is impelled by a complete knowledge of his subject by the lecturer—and when it is enthused with the magnetism of the enthusiasm of the true teacher, —which commands the attention and makes the minds of the auditors receptive of the subject matter being taught.

It will be a long time before the human voice will be silenced as a medium of imparting knowledge by exclusive laboratory teaching. The appreciation by the organs of hearing should be assisted by the organs of seeing; in grasping the trend of the lecturer's words. Did you ever think that if knowledge is received by hearing alone that each side of the head presents a hearing hole? It too often happens that the knowledge goes in one hole to come out the other; but when knowledge enters by the pupil hole of the eyes, it is more apt to be retained, as there are no holes at the back of the head for it to escape.

Now, I wish to show you the method I have resorted to for over twenty-five years, to illustrate my didactic lectures on anatomy. I must say here that I consider prepared dissections as aids to illustrate didactic lectures as useless for purposes of demonstration to audiences of over ten students. I have to plead guilty to being the author of a book on "Practical Human Anatomy," which is illustrated from my own dissections of the entire body. These dissections are arranged sequentially to display the complete anatomy of a given region. I have had lantern slides made of these illustrations, and one of these is always on the screen as my lecture progresses. My object is to evolve as I progress, a verbal description of the region which appealed to the hearing at the same time that a pictorial verification of the description is demonstrated for the appreciation of the scene. In this way I can effectively impart the knowledge of the subject to auditors by the hundred. After the student has listened to the lectures, the volume of illustrations becomes his text book, which he can study and he can take it to the cadaver, prepared to recognize what his dissection develops, and thereafter—having found that the illustrations are true reproductions of nature—the volume becomes to him a *vade mecum* which ever reminds him of his dissections. The kindness of your executive committee in obtaining lantern facilities for me, enables me to exhibit to you some of these sequential dissections for illustrating didactic lectures on anatomy, which are within the reach of all lecturers on anatomy and where dissecting materials are not abundant, they can, in a great degree, compensate for it. This I know to be a fact, as for several years the dental institutions of the state of New York could not obtain dissecting material under the anatomy law, and these slides were my only aid in teaching anatomy, and during those years, my students acquired a knowledge of anatomy therewith.

(Here followed exhibition of lantern slides of sequential dissections of face and thoracic subregions.)

DR. WM. C. BARRETT, Buffalo, N. Y.:

I am not a teacher of anatomy and therefore am not competent to discuss this paper. However, Dr. Borland is my associate in the faculty of the Chicago College of Dental Surgery, I am acquainted with his work and believe that I have cause to congratulate you upon having listened to this very excellent paper, and myself for having him as a co-laborer. I merely wish to verify what he has said.

DR. A. O. HUNT, Omaha, Neb.:

I will not take up your time for more than a moment as I wish to refer to only one point mentioned in the paper, and that is the use of the blackboard and chalk. I am fully satisfied from experience that the very best of models and charts do not impress upon the mind of the student so clearly and so quickly what you desire to have him know as a thorough and liberal use of the chalk, doing this at the time that you are delivering your lecture. This method has many advantages; the principal one is that while you are working the student's interest is naturally directed to what you are doing. He is bound to follow you in your work. Some will say that only a few men can do this, but

I am inclined to believe that more could if they would only try it. It is not a difficult matter to make an outline drawing: it may not be absolutely correct, but it is sufficient to convey the idea of what you are talking about, clearly, quickly and concisely to the student.

(I wish to offer a motion, if it is in order; Dr. Borland is not a dentist, although a teacher in a dental college; he has come among us, giving us his methods of teaching, and I move that a vote of thanks be extended by this institute to Dr. Borland for his courtesy. Motion was carried.)

DR. W. H. WHITSLAR, Cleveland, O.:

The essayist said that the didactic teacher should also teach proper pronunciation. I therefore arise to say that in the pronunciation of the word anatomy, it should be an-at'-o-me and not a-nat'-omy.

TEACHING APPLIED PHYSICS.

By G. V. Black, M.D., D.D.S., Chicago, Ill.

In dentistry there is so much that should be approached by the student from the general standpoint of the phenomena usually classed under the head of physics that it has seemed to me that it would be best to group these into a special course of instruction that should in the main assume the character of laboratory work.

This would be very distinct from the technic courses which I introduced in 1888 which have since had their regular place in dental schools, and have produced excellent results. These courses serve to train both the mind and the fingers in the technical procedures in dentistry, and incidentally give the student a certain practical acquaintance with the physical properties of the materials which he handles. Through this work he learns, in operative technics, the physical forms, or the anatomy of the teeth, their behavior to cutting instruments, gains a special knowledge of the hardness and brittleness of enamel and dentine, gains some knowledge of the properties of steel, and of the forms and uses of steel instruments in dentistry. In prosthetic technics the student gains a similar knowledge of the metals, porcelain, rubber, Plaster of Paris, and other material things that we use together with the technical procedures in that use.

In all of this teaching the principal factors are the technical procedures and the training in finger skill. The teaching of the physical properties of the materials is incidental and such as is derived through the senses by the ordinary handling of the material. In our professional development it is becoming apparent that something more is necessary to properly equip our students to meet the requirements of practice. The question comes as to whether we will be able to develop this, now that we will have a course of four years instead of three. The object of this paper will be to point out the general subject matter of such a course rather than to attempt now to give the particular forms of the laboratory teaching.

In this course in applied physics it has not been my thought to do much with the general subject of physics as taught in our high schools and colleges. Our students should come to us with at least the outlines of this knowledge, though with our present requirement of only two years in the high school many of our students have but a slight knowledge of it; many, none at all, while the few only are really well prepared. Some of our high schools have well equipped physical laboratories, some are indifferently equipped, and many have no laboratory apparatus whatever. I have studied this matter pretty closely in the credentials of students and the reports from high schools, and find with some chagrin that the high school work, even to graduation, cannot be relied upon as a good preparation for the work in applied physics that we need to install in our dental schools. Our students ought to come to us well grounded in the phenomena of force and motion and the physical relations of the more common material things to these phenomena, but as a body they do not. This is all the more surprising when we consider that the material improvement in our knowledge as a people upon which the great prosperity of the nation is based is principally of the laws of force and motion in their application to material things. For these reasons it is probable that a part of the time of a class in applied physics should be spent rather upon some portions of the general subject as well as upon the application of physics in dentistry.

I should think it especially well to go over the detail (briefly) of electrical phenomena, in their relation to the production of motion (or power) and heat, and the conditions of its use in motion and heat production. This much seems to be demanded by the extensive employment of electricity in dentistry. This should be a laboratory course with sufficient apparatus to display the phenomena very fully and enable each student to develop them himself under proper direction. The course should include wiring, placing fuses, etc., with all necessary precautions for safety, determinations of polarity, voltage, placing of resistance apparatus, etc., and the effects of these in their relation to heat and motion production under all of the known conditions of the use of electricity in dentistry.

The X-Ray, which has come into such prominent use in orthodontia and oral surgery, should receive its share of study. This, on account of its necessary connection with photography, would for the present take the form largely of demonstration, such as would render students familiar with the general detail of its use, the conditions of its successful use, and the conditions demanding its employment.

The other subjects taken up, while purely of the physical type, and to be dealt with as studies in physics by laboratory methods, would be especially dental subjects applying, if possible, more directly to our daily operations. They would be such as the following, which I will present briefly as questions to be answered by laboratory exercises with the proper physical apparatus, or as studies to be pursued in a similar manner. The necessary physical apparatus or instruments for this work have now been developed in nearly all of its lines, but I have no doubt that with the general adoption of such a course many improvements would quickly follow.

What force can be exerted by the human jaws in closing the teeth? What are its averages, and its variations among healthy normal persons?

What is the average force used in chewing foods, its normal and accidental variations?

What is the average weight endurance, without actual pain, of the peridental membranes of different classes of teeth, as molars, bicuspids, incisors, etc., and what are the relative capabilities of the roots of these several classes of teeth in sustaining crowns and the abutments of bridges? These would be determined with the gnathodynamometer.

What is the apparent necessity of X-Ray pictures for ascertaining the length and strength of roots of teeth upon which abutments of bridges are proposed to be sustained?

What is the average and the ordinary variations of force required in crushing particular articles of food? Determined with the phagodynamometer.

What is the actual strength of a human tooth, incisor, cuspid, bicuspid, or molar, as a whole, to breaking or crushing force, first against steel, against which but a minute area of tooth surface will be engaged, then against annealed brass which will be slightly indented allowing the contact of a greater area, then against lead and the softer metals, or against hard wood? These would be determined with the dynamometer on freshly extracted teeth, or those that had not been allowed to dry.

What is the strength of walls of cavities to breaking stress in conditions in which we find them in practice? (This would be done by selecting and preparing cavities in freshly extracted teeth and then submitting the walls to breaking stress in various forms with one of the dynamometers.)

What is the strength of blocks cut from human dentine (8-100 inch square) and the comparative strength in the different blocks from the same tooth and in the teeth from different persons. This would be more difficult of introduction because of the expense of the necessary machines for cutting the blocks.

What is the strength to crushing or breaking stress of blocks of porcelain especially made for test in definite sizes. This would give the first practice in breaking porcelain under conditions controlling exactness of work and accurate determination of results.

What is the strength of porcelain teeth as mounted as artificial crowns? (Trials of different forms of mounting and different manufactures of teeth.) In this, crowns would be mounted in the technic laboratory for trials in the physical.

These trials would be made with the dynamometer so rigged, or arranged that the tooth might be held at any angle to the line of force to obtain its strength at the different angles of force found in the occlusion and the varying inclinations of the teeth in the mouth. This set of tests tell some wonderful stories of the variations of strength in the various positions and inclinations in which teeth are mounted. Often teeth that will sustain a load of one hundred pounds in one inclination will break at fifteen pounds in another. And with sufficient study of these tests such differences can be predicted with certainty when the relation of the tooth to the line of force is seen.

What is the power of pure hammered gold to sustain stress, taken in blocks of definite size, say one-tenth inch square, or what pressure in pounds will be required to reduce the length 1 per cent, 5 per cent, 10 per cent, etc.?

In what proportion is this power lost in annealing?

What temperature (about) is required in annealing as shown by the softening apparent in dynamometer tests?

(All of this class of tests must be made with the dynamometer with micrometer attachment in which the reading of pounds pressure and amount of condensation are obtained as one operation.)

What is the effect upon the power of gold blocks in sustaining stress of 10 per cent of alloy, of silver, of copper, or of 10 per cent of alloy, of equal parts of silver and copper, etc., or of other metals *ad libitum*?

What is the stress required to bend bars of some definite size of pure hammered gold or platinum? What is the effect of annealing these bars on the stress required to bend them—on the stress required to break them? What is the relation of this stress to the strength of the human bite?

What is the relation of bending or breaking stress to the length of the bars, the size being equal?

What is the effect as to bending or breaking strength of alloying platinum with 5, 10, 15 or 20 per cent of gold or of alloying gold with similar proportions of platinum or with silver, copper, or silver and copper, etc.?

In all cases the tests should be made with hammered or hard rolled bars and with annealed bars. These tests would be made with the dynamometer or with falling weights.

Tests of the fusing temperature (comparative at least) can readily be made in the electric furnace that will develop the physical characters in that direction and give valuable practical instruction regarding the formation of solders. Tests of the *fluidity* of solders of different compositions may readily be made in the electric furnace by comparative rotundity or flattening of globules of definite size brought to degrees of heat between the melting point of the solders and metals to be soldered and allowed to cool on a flat surface. This fluidity has directly to do with the *easy flowing* of the solders.

What is the density or specific gravity of pure hammered gold? What density may be attained in making gold fillings by hand pressure, or by mallet pressure, using steel matrices?

This test of density should be made by weighing in air and in water at a given temperature, and also by measurement and weight and checked up for comparison.

The same gold blocks are then tested for condensing pressures with the dynamometer and the results checked up for comparison. In this experience will show that the force of the blows used, and the character of the resistance (whether the matrix is held upon a solid or a spongy support) used in making the filling, may give a hard filling resembling hammered gold or a soft filling resembling annealed gold with similar differences in their power to carry heavy stress with or without marked yielding. These fillings can now be made in the manudynamometer in which each thrust of the instrument with its force in pounds may be recorded, or in the tuptodynamometer with a similar record of the number of blows and the force of each.

A study of the force of the hand pressure thrust with the pen grasp and with the palm grasp with their variations in different individuals by use of the manudynamometer.

A study of the force of the blows of the mallet and of the condensing power of mallets of different weights with the tuptodynamometer.

A study of the force of blows with weights of ½ oz., 1 oz., 2 ozs., 3 ozs., etc., falling from different measured heights with the falling weight apparatus. This may be done on the tuptodynamometer with polished blocks of boxwood, showing the penetration by comparison with a thrust pressure of a definite measured number of pounds made with the registering dynamometer. This will give evidence of the actual number of pounds contact force in blows delivered as distinguished from foot pounds, or the impulse of the blow. This latter may be more accurately studied by delivering the blows of falling weights and the dynamometer thrusts on blocks of annealed brass with instrument points of definite measured size and measuring the penetration with a micrometer that will work easily and conveniently to the ten-thousandth of an inch.

This study will open up in a definite experimental way the whole question of the contact force of blows in comparison with the foot pound power or impulse producing force. This and the instruments for its development are new, in the combinations used, to the science of mass motion and force and will develop a distinct line of new facts regarding the contact force in mass motion and resistance. This study may be varied in a multitude of ways, giving a wide insight into this very interesting subject. It will, in all of its variations, give a wide divergence between foot pound force, whch is impulse producing, and contact force in pounds weight. The contact force measured in pounds is the condensing force used in condensing gold, not the impulse producing force, or foot pounds. Much of the text of the books on physics may be used in this study.

A study of amalgam alloys.

The formations of amalgam alloys of silver and tin, melting in air, or in the open crucible, melting under fluxes and a study of oxidation and loss. Melting in the closed electric crucible with studies of differences in oxidation and loss.

A good short line of studies may be had by forming alloys of silver and tin in the following proportions: Silver 40, tin 60; silver 50, tin 50; silver 60, tin 40; silver 70, tin 30. For testing the modifying metals, five per cent of the silver may be substituted by an equal weight of copper, zinc, cadmium, gold platinum, aluminum, etc., *ad libitum,* and these combinations will be used in the tests of alloys. Other lines of formulae may be adopted in greater or smaller number, giving such range of study as time will permit.

In this there is accurate practice in weighing metals into the crucible and weighing the ingot, also in taking the specific gravity of the metals before placing in the crucible, finding the mean specific gravity, and then taking the specific gravity of the ingot and noting the condensation in the formation of the alloy. This, if done with sufficient accuracy, becomes an index to the degree of actual alloy formation as distinguished from the mere mingling of metals without actual alloying.

Cutting alloys, annealing cut alloys.

Experimental studies of the proportion of mercury to alloys required to make amalgams with alloys composed of different proportions of silver and tin.

The same experiments repeated with the same alloys after annealing, showing differences in the proportions of mercury required in making amalgams with fresh cut or unannealed and annealed alloys, and the variations in the consistence and physical qualities of the amalgams formed. In this there is also accurate practice in weighing alloys, mercury, and the mass formed, shewing also percentage of loss in handling.

Still using the same alloys. Fillings are made in steel tubes using the binocular microscope in testing accuracy in finishing to margins followed by measurement of contraction and expansion during setting and following setting, or until movement ceases, a period of from five to thirty days.

In these tests each experimental filling would be followed with micrometer tests, observation of the movement with the binocular microscope and in companion fillings with specific gravity tests until movement ceased.

Also tests of the results of mixing instead of actual alloying, which give very striking results, are made by weighing one-half the amount of alloy required to make a test filling, and then adding to, and commingling with this an equal part of the fillings of silver and of tin in the exact proportions in which these metals exist in the alloy. This mixture is then treated in every way as the alloy in making an amalgam and carried through all of the tests.

Examination of the stress required to crush fully set amalgam blocks to obtain the comparative strength.

A study of the flow under stationary stress of each amalgam to obtain its power of endurance under stress.

These two studies will be made with small blocks of definite size made from the same alloys used in other tests.

A study of the shrinkage and expansion of oxyphosphate cements by making fillings in steel tubes followed by micrometer measurements and observation with the binocular microscope under varying conditions of mixing. Also when kept dry and when kept wet using various makes of cement.

A study of the penetration of cements by colored fluids which denote the degree of penetration of moisture. These studies give good perceptions of the usefulness, or uselessness, of the various cements for temporary fillings and if followed by chemical experiments displaying their solubility will give a fairly good idea of their probable endurance.

A study of the expansion of Plaster of Paris with a micrometer for its accurate measurement.

Then a study of the warping of plaster under the conditions of its use in taking impressions and making casts.

In this there is a wide range of opportunity for the teacher to display his ingenuity in improvising cheap apparatus that will show to the eye exaggerated warpage and the conditions of its occurrence.

This should be followed with a study of plasters from different sources, together with a study of methods of keeping after calcining, or of the effects of weather upon the plaster and the necessary precautions to maintain the physical properties of plaster in the best condition for our use.

I have now enumerated subjects of study, every one of which is important in dentistry, the reasonably perfect pursuit of which would require the time of the student three hours per day for two years of the dental school course of seven months each year, excluding holidays and the time taken up in examinations. It is at once clear that as schools are at present constituted, or as they will be in the four years' course, this work can be done only in part. Much abridgement would have to be made in any attempt to follow out such a course. For instance, a course in amalgams may be undertaken with several different ideas in view. First, it may be undertaken with the view of that completeness of the study of the metals and their manipulation as will render the student fit to undertake the commercial manufacture of alloys. This would require 288 hours of laboratory work, two-thirds of a year, three hours per day. This is clearly not the dental student's province, and not the work of the dental school as such. A very much shorter course will render the student intelligent as to the physical properties of alloys and the basic principles of their formation and use. This he ought to have as a dentist. This he must have in order to use amalgams in a manner to develop the highest good in their use. For this a well selected abridged course occupying three hours every other day for six weeks (90 hours) would give a fair degree of instruction. This could be given in sections in which about eight students could be grouped with one set of instruments, with the exception of the cheaper articles, as tubes, matrices, etc., and materially reduce the expense for instruments, while some of the more expensive instruments, as the amalgam micrometer, measuring to ten-thousandths of an inch or to microns in the metric system, would be really used mostly by the demonstrator and one would answer for the entire section. By certain inexpensive modifications the amalgam micrometer becomes the essential instrument for all of the very delicate measurements, and may be used for many purposes in various parts of the course.

A course in the examination of the physical properties of gold similar to that detailed would be a most important part of the work. The importance does not relate so much to the gaining of knowledge that gold has such and such a specific gravity under such and such conditions as in having seen and realized the conditions and having worked them out by exact methods. The simple filling of a matrix with gold and making test of its density is of less value than the study of the particular methods of making the filling, the force used, the perfection of the surfaces against the walls and in angles of the matrix as observed by microscopic examination after removal of the filling. These combined observations tell in shaping the future practice of the student. This is a class of observation the student cannot obtain with present methods of teaching. A very extended course is not so necessary as a very carefully conducted course.

The double bow spring dynamometer with micrometer attachment making measurements at one-thousandth of an inch or to a similar grade in the metric system, as desired, used especially in the gold and amalgam work, is another of the very expensive instruments that may, by cheap arrangement of points and holding apparatus, be made to do duty in all departments where accurate trials of strength or measurements of compression are required.

The *thrust dynamometer*, which I called the phagodynamometer at first because of its special arrangement for testing the force required in chewing food, is by varying the arrangement of its jaws to different purposes serving a multitude of purposes, and by reason of the great facility of use it at once becomes the instrument for the measurement of force in breaking and bending stress under any conditions in which the measurement of condensation is not a feature of the operation, as for breaking porcelain, porcelain teeth, bending bars of metals, etc., and registering the number of pounds required.

The falling weight apparatus is less extended in its uses, and more nearly confined to uses in the more purely scientific sense, and yet serving to impart very practical lessons. It is particularly essential in the study of the effect of mass motion and the contact resistance in the arrest of motion. When used in conjunction with the tuptodynamometer and the thrust dynamometer for this purpose it becomes one of the essential instruments in measuring accurately the contact force of blows such as are given with the mallet.

In all of this study of mass motion, resistance, contact force or impulse producing force developed by blows, and gaining an insight into the real nature of these it is one of the essential pieces of apparatus.

In the teaching with this instrument much of the subject matter may be drawn from the text books on physics and yet none of these will be found to develop the material facts of the force developed in the contact of mass in motion when meeting with absolute or modified arrest of motion by resistance, as I should wish to display it with this instrument. This, of course, cannot be further discussed in a paper of this character.

The manudynamometer is the most essential instrument in giving the student a correct estimate of the power with which he is able to handle instruments and in pointing out his deficiencies. Practice with this points the way to essential improvement, partly by showing the differences among persons in the development of the muscular power of the hand, partly by the direction this gives to effort, but most important of all it brings the teacher and student to understand each other in the use of terms relating to the use of force and renders teaching along all of these lines more exact and impressive.

The expense of these instruments is a serious drawback to the introduction of such a course, for without them a laboratory course, such as is contemplated, is out of the question. If there were orders for a sufficient number at one time the expense of the instruments could be materially reduced, for the reason that the wholesale manufacture is very much cheaper than making single instruments. The instruments can be conveniently made in sets of about twelve or sixteen of each, but would be still cheaper if fifty or a hundred could be made in a single lot. If made in that way, by the wholesale, they would not be very expensive, for such an order would justify the development of special apparatus for their manufacture.

Supposing the instruments to be made in lots, half dozen each, the cost would be something as follows:

Amalgam micrometer with 50 tubes	$125.00
Double bowspring dynamometer with micrometer attachment	75.00
Thrust dynamometer	50.00
Fixtures accompanying	25.00
Falling weight machine with anvil	45.00
Tuptodynamometer	60.00
Manudynamometer	60.00
Accessories	50.00
Gnathodynamometer	20.00
Binocular Microscope with ¼-inch lense	60.00
Machine for cutting teeth, with electric motor	80.00
Scales and weights and accessories for specific gravity and other work	40.00
Expansion micrometer for Plaster of Paris	50.00
Electrical apparatus	100.00
Crucibles for melting metals, electric	10.00
Total	$850.00

The cost of material per student would be from five to eight dollars, principally for gold and platinum, while more than this might be used. Most of the noble metals, except gold foil, could be sold for about their cost, the expense representing the loss.

In making out the list it has been supposed that certain of the electric motors, electric ovens, electric annealers, etc., in ordinary general use in the school might on occasion be used in the physical laboratory. If we must suppose that all of this be especially purchased the expense would be greater. The X-Ray apparatus has also been left out of this count.

Some of these instruments, and especially the more expensive ones, can be made to serve the whole class, even in the larger schools, but matrixes in which to make experimental fillings, electric crucibles, and many of the less expensive accessory pieces would need to be duplicated so that each would be used by a small section. A binocular microscope would serve a group of six or eight students very well, and as this instrument is used in but a portion of the course it is not impossible that by a skillful handling of the class so that the different small sections would at the individual exercise work at different things, much saving of duplications might be effected.

DISCUSSION.

Dr. Geo. H. Wilson, Cleveland, O.:

I am sure that it has given us all a great deal of pleasure to listen to this very excellent paper. I must say, however, that I feel that I am somewhat unprepared to discuss it because it so happened that the copy of the paper was not placed in my hands until after I reached Chicago. We all appreciate that Dr. Black is a very competent man; his shoulders are broad in many ways, and, perhaps, this is not a bad time to hit others over his shoulders at the same time that we hit him. The more valuable the paper, the greater the necessity of placing a copy in the hands of the discussers before the time of the reading of the paper. If the copy is not given you until after you reach the place of meeting, I think you will agree with me that there is not time enough to prepare a discussion which would do justice to both the essayist and his discusser. It is impossible for me to go into an extensive discussion under these circumstances, and yet there are so many points in the paper on which

I wish to touch in passing that I think I can give you enough on the subject without having had any preparation.

So far as most of the paper is concerned, I do not wish to consider it. It speaks for itself. The various appliances which the doctor presented and exhibited also speak for themselves. But there are some principles that underly it all on which I wish to speak. As to the question, whether or not physics should be taught very extensively in our dental colleges, I do not like the term physics at all. It is really a word of modern coinage. Some twenty or thirty or more years ago, when some of us were attending school, we called this particular science "natural philosophy," and I have noticed that there is a disposition to go back to that term again at this time. That term is a vastly better one than "physics"; it conveys more of an idea to our minds; philosophy—the reason for things, of natural things or natural phenomena. Surely there is no one present who would question the usefulness of the study of natural phenomena in dentistry. In fact, we might go so far as to say that in dentistry there are but two subjects which are required for a foundation; one is natural philosophy and the other is physiology. These two studies in themselves form the real foundation of the whole subject of dentistry. If we are going to understand dentistry we must study fundamental principles which are involved and we find these in physics and physiology. All the other studies are developed from these two.

It has been said a number of times during this meeting that the great idea of our dental teaching is to make dentists. That is correct, if we have the correct idea of what a dentist is. We do not understand that when the student goes out from the college he is as perfect a product as he will be when he has been out five or ten years. In order to turn out such a dentist it would be necessary that we place the student at the chair as soon as he enters college and keep him there until he goes out at the end of the third or fourth year, and even then, perhaps, he would be only a moderately good operator. But it seems to me that there is something more than that necessary, and that is for us to lay such a broad foundation for him that he can in time develop into a good operator. I believe that when a man has been properly taught, and has been given the practice of inserting from a hundred to two hundred gold fillings and such other operative work as is demanded of him, that he has as much practice and experience and training as it is possible to give a student during his three or four years at college. If he has not acquired the knowledge he should have, then he should be required to take a part of his work over; he should not be retained in the regular course of study.

So I say for that reason the mere ability to fill cavities and do other operative work is not the making of a dentist. We want to give him a good, broad, liberal education. How can we do it? First, by enabling him to make use of his knowledge to become a dentist; give him a knowledge of the literature of our profession and enable him to use it correctly. A man with a good, broad education must be able to think and draw conclusions; and in dentistry he should have that power. The great object in teaching dentistry is to enable the man to do something. The dentist should not expect to be able to render the same service to his patient when he leaves college as he can after he has had years of experience. I do not believe that any patient expects that. If they did what would be the value of the many years of experience that we count so much on? If they did, there would be no reason why the man just from college should not be entitled to the same compensation as the man who has had twenty or thirty years' experience, and whose work has received recognition.

If a man has great ability and is a leader in his profession, it means that his foundation was well laid. At the same time, if there is a time in a man's life when he can lay a good foundation it is during his college life. If he fails to do it then, he never will.

As a teacher I want my students to have a broad foundation in school. I know of no way to illustrate this better than to speak as a father. I have a son who entered college this fall, and the method I am pursuing with him would, perhaps, express my feelings better than anything I could say at this time. I expect that he will apply himself for, say, three and a half hours a day at the dental technic work; that is, prosthetic, operative, etc. Then, in the latter half of the term he will have the practical work; plate work, crown and bridge work, operating, perhaps, for about five hours a day. The rest of his time I will expect him to devote to the scientific part of his work, laying his broad foundation. Now, what will he do during that time? I will say that it will be largely laboratory work of one kind and another, especially in the physical laboratory, which should be the important part of the work. But I believe that, on account of the great cost and the delicacy of construction of the various appliances used in this work, that it will not be practicable to place them in the hands of the student to use by himself. It should be more of a demonstration course, the instructor carrying on the work and demonstrating to small sections of the class so that every student can see and carry off the idea of what is done and what it is done for. I think that they could acquire the necessary knowledge in less time when the work is done in that way than if they could use the instruments themselves and work out the course individually; this would also consume a great amount of time, more than they have at their disposal.

There are other branches of laboratory work that I feel are fully as important as the course in physics. Take, for instance, the use of the microscope in histology. This work will be done during his first two years in college and will consist of the mounting of a hundred or more microscopic sections. That is fine manipulative work, work that requires exactness and the careful consideration of details in every respect. It is a means for cultivating honesty and truthfulness. If he is not honest in preparing his slides, his work will show it in the end. So that in selecting work for the student it should be done with a view that it will develop manipulative ability, and the power to think logically and to draw conclusions, and then I believe we will have men who are better dentists than we had twenty or thirty years ago.

In the case of my own son, I believe that he can to-day, although in college less than a year, do more artistic, more ideal, better work in prosthetic dentistry than I could after I left the dental college with four and a half years of preparatory work. If he has that better foundation and ability, it is because of the different method of training he has had. I am firmly convinced that we are producing better dentists to-day than we did twenty or thirty years ago. So that as we enter upon the four years' course in our dental schools, I trust that it will be our aim to put in as extensive a course in physics and other laboratory work as possible, because I believe that it is a great source of instruction. There are other departments of physics that the student should be instructed in, but it need not necessarily be laboratory work; it can be taught in the lecture room accompanied by thorough demonstrations.

Dr. Black has confined himself almost entirely to the application of power, of force. I believe that they should also receive considerable instruction in the physics of light. If the members of the dental profession had more knowledge of that subject to-day, we would not hear so much discussion about the different ways of putting in inlay work; whether it should all be of one material or of different layers, or of different qualities of material. Some materials which are highly recommended would not be considered at all because they would appreciate the effect of light on the inlay.

So I believe that the principles underlying physics or natural philosophy should be more thoroughly taught in our schools. Of course, the laboratory method of teaching is much slower than the didactic work, but a portion of the time could profitably be put in in the laboratory and then the teacher could fill in by thorough demonstrations in the lecture room so that the students would get a complete course, one which would be of considerable value to them in their career as dentists.

Dr. J. P. Buckley:

It is with a degree of reluctance that I attempt a discussion of this very elaborate and comprehensive paper, for I am not a teacher of physics, except that in teaching chemistry, which pleasure I enjoy, it is necessary, oftentimes, to consider the subject of physics, as the two branches of science are very closely related.

We are fortunate at this time, I take it, in having this subject presented by so thoroughly competent a teacher as our essayist. Few men, indeed, in our profession have spent as much time applying physics to dentistry as has Dr. Black, and as a result of this application he has made many valuable discoveries, which have greatly benefited the entire dental profession.

Before we can enter into an intelligent discussion of the subject of teaching applied physics, it will be necessary, first, to know what is included in general physics, and then decide upon the special subject to be treated in our applied course.

General physics is a science which correlates with algebra, geometry and chemistry. Its correlation to chemistry and metallurgy is of special interest to us, as dentists, and must ever be remembered in teaching applied physics, as was clearly shown in the essay. Both physics and chemistry are sciences which deal with matter; matter constitutes the universe, the parts of which are so intimately related that it is impossible, in many instances, to establish any sharply defined boundaries between these branches of science. I know it is true that we usually think of physics as dealing with the phenomena of matter involving simply a change in position, form or condition; and chemistry as dealing with the phenomena involving a change in composition, but the distinction in nature scarcely exists. General chemistry has always been taught and fully appreciated in our dental schools, while physics, as such, has been given only little attention, if any. That a course in applied physics should be installed in our four-year curricula is self-evident, and I am going to take the liberty, just here, to wander from the theme of this discussion long enough to say that a course in applied chemistry should also be inaugurated.

The essayist has mentioned the practical subjects which, in his opinion, should be taught in this special course. Now it will be difficult to teach students applied physics unless they have some elementary knowledge of the science; and, in order that we know where to begin this work, it will be necessary to ascertain as nearly as possible the amount of elementary physics studied by the students previous to entering our dental schools. As most of our matriculants are high-school graduates (it is to be hoped all will be in the near future), we must know approximately how much physics are taught in the average high-school.

It was my pleasure, a few years ago, to be connected with the teaching force of the state of Indiana, and in that capacity I was privileged to meet the teachers in conventions from other states. At that time, physics was taught in the high-schools from the standard text-books. I learn, however, that the general trend in teaching the subject to-day is towards more experimental work in the laboratory. This is necessarily limited, on account of lack of equipment. I also learn with a great deal of satisfaction that the high-schools throughout the country are working towards a unification of their courses, not only in physics, but in other branches as well. This is certainly encouraging and gratifying to the professional schools, who are to accept these graduates and complete their education.

The essayist has brought to our minds quite forcibly the fact that there is much in the science of physics which appertains to modern dentistry; but I fear, in teaching this application, we shall be laboring under grave difficulties, until some capable teacher assumes the responsibility of writing and having published a thoroughly up-to-date text-book, and laboratory manual, which will be correlated to chemistry, metallurgy, materia medica, pharmacy and other branches of dentistry, in such a manner that the subjects mentioned may be studied with reference to their interdependence upon each other, both in the lecture-room and in the laboratory. This text-book should contain nothing but that which is true and capable of being verified by the teacher. It should be composed of the practical ideas from all good text-books, together with new ideas on applied physics not yet published. With such a text-book and manual, a uniform course could be given We are sadly in need of good, modern text-books. There are too many subjects taught in our dental schools to-day which have to depend for their essence solely and entirely upon the practicability and individuality of the teacher This institute, it seems to me, could do the profession generally no greater service than by exerting its influence in having some of its specially qualified members write and have published up-to-date text-books upon applied physics, materia medica, chemistry and other branches which could be mentioned.

I shall not attempt to suggest specifically what such a text-book on applied physics should contain, but by giving some thought along this line we find many practical subjects suggesting themselves. The essayist has considered in detail the application of forces, and the principles of mechanics, to all phases of dentistry, and carries it into what I should more properly specify as a course in applied metallurgy. While I consider this to be thoroughly interesting and practical, I feel that he has emphasized this application of forces, in teaching applied physics, at the expense of other important subjects, such as heat, light and electricity. Where or in what calling is *heat* used more than in dentistry? Who should know more about its sources, effects, transmission and application than the modern dentist? Light:—its sources, intensity, reflection and refraction, should be thoroughly taught to our dental students, for light is an important factor in the mouth, in many instances, as well as in the operating room and laboratory, and no dentist is thoroughly up-to-date unless he knows how to handle such instruments of precision as the microscope, photo-microscope, polariscope, X-ray apparatus, etc., all of which depend upon some phase of light for their value. Electricity has been more fully considered in the essay than the subjects of heat and light, yet not as fully as I feel it should be in this special course. This phase of physics has also been treated by itself before this body, and I shall not take up your time by repeating the discussion more than to say that electricity should be thoroughly taught in our course of applied physics.

Perhaps second in importance to a good text-book in teaching these practical subjects, and absolutely necessary in the absence of such, is to have a teacher capable of presenting them in such a manner that they will be interesting to the class.

The general pedagogical principle underlying the method of teaching applied physics differs in no particular essential to that which underlies the method of teaching any subject. A teacher can never interest a class unless he has the ability to hold their attention, and the attention of the class can be had in one of two ways only:

By arousing their curiosity, or by showing them that that which we are teaching has a direct application to their future life. Personally, I never had much sympathy for the teacher who has to prey upon the curious nature of the students in order to hold their attention. The valuable teacher—the one who *teaches*—holds the attention and never fails to interest the class, because the practical application of the subjects taught is never neglected. This causes me to reiterate a similar statement, which I made before this body a year ago, in discussing a method of teaching dental metallurgy. In teaching applied physics or physics as applied to dentistry, the teacher must have two special qualifications—a thorough knowledge of elementary and advanced physics, and a knowledge of the practice of dentistry.

Dr. Black (closing the discussion):

I do not know that I should take up the time of the association in saying anything further upon this subject. Of course, I realize that it would be impossible to have any considerable discussion because the subject is new to the dental teacher. I am sorry for that, but I am well satisfied that in a few years from now this subject will form a prominent part of the dental curriculum and then we will be in a position to speak further as to the value of a course in physics in the dental school.

SYMPOSIUM ON THE MANAGEMENT OF TEACHING BY DEMONSTRATORS IN THE INFIRMARY.

By Dr. S. H. Guilford, Philadelphia, Pa.

I am not prepared to present this subject fully for the reason that I did not give it the consideration I should. Further, when we are familiar with a subject we rarely prepare ourselves for public expression. What I shall have to say will be largely along the line of what I am familiar with in our own school.

To begin with, we all, from time to time, have to get new demonstrators for the infirmary or other positions in the college. Some men leave because their practice has grown and requires a greater amount of their time, and they cannot afford to do work in college; some for other reasons. Hence we are constantly on the lookout for men to fill these positions. Now, let us suppose that a vacancy occurs and after looking around we find some one who is capable of filling the position. The first thing to do under the circumstances, because in all probability he is a man who graduated some years before, is to bring him into the college and acquaint him with the present day methods in the school. We take him in hand and explain to him exactly the way in which we conduct our infirmary; tell him the duties of the demonstrators; what they are expected to do, and what not. Give him to understand who is the chief man in authority; who comes next, and also what his particular position will be. After that is done, and placing him in the infirmary, it becomes necessary to visit that infirmary from day to day to ascertain whether he is doing the work properly and carrying out your instructions. After he has been appointed it is also necessary to place him in proper relation with his associates in the infirmary and give them to understand that he is there to do certain specified work.

Every infirmary must be properly organized in order to get the right amount of work out of it. We have head men, men next to them, and several assistants. Those men who act as assistants usually have some specific work to do. One, for instance, will pay special attention to the pathological cases; another to the practical work, the crown and bridge work. Others, possibly, to the preparation of cavities, the insertion of fillings, etc. Of course, all the demonstrators are prepared to take hold of any part of this work, but each one is supposed to have individual control over his particular portion of the work

Now, if we find that this work is going well, and we are supposed to see that it does, another thing is necessary. It is not sufficient to have the head demonstrator and the assistants working in harmony unless you are there with them and understand them. In order to get a full understanding it becomes necessary to have a certain number of meetings during the winter between the professor who superintends that work and the various demonstrators. These meetings may be held once every two weeks, at which time the work in the infirmary is gone over. Ask questions about the clinic; the run of the cases, whether any peculiar or unusual cases have presented themselves, and in general what work is being done by the demonstrators as well as the students. You can give special instructions at this time; or if they are not carrying out your ideas properly you can set them straight.

Those who demonstrate in the infirmary, or have charge of this work, must be in perfect accord with the didactic teachers in the various chairs. In order to do that we have found it necessary, when a new demonstrator is appointed, to have him attend the lectures on that subject and become familiar with the professor's teaching and his methods. We also require that those who have been there for some time go in occasionally and attend the lectures. But the new man must attend all of them in order to brush up on anything new that has occurred since he left college. In that way, the new ones as well as the old ones are in perfect harmony and accord with the chair, and if they have any executive ability at all they ought to be able to carry on infirmary work.

I need not mention the fact that all the infirmary work should be very carefully supervised by the chair having that in charge, in this case the chair of operative dentistry, so as to see that everything is going well.

I realize, and have for many years realized, the difficulty of getting good demonstrators, or taking such material as we can get and moulding it into good demonstrators. It is one of the hardest problems of my life to get suitable men to serve as demonstrators. I remember many years ago Dr. Brophy said to me, "Can you send me a good demonstrator from the east?" I said, "No, I can send you a dozen good professors, but not one good demonstrator." Professors are comparatively numerous, but good demonstrators are very hard to get. So that in my official position I am constantly on the lookout for good material. It does not do to wait until a demonstrator leaves and then take steps to fill his place. I try to have an understudy for every demonstrator in the college. I put him in as an assistant and prepare him for the work so that when the time comes he can step right into the demonstrator's position.

It is very well to have the different chairs filled by competent professors and teachers, but at the same time it is just as important to have men under you who are able to carry out your ideas and instruct the students properly. A teacher is made, and not necessarily born, as we hear it said so often. His efficiency is largely developed through long practice. You can hardly expect anyone to take up a certain line of work and do it well at the start. He must be trained to do it. The success of every institution depends not only on the teaching but on the actual demonstrations in the infirmary, and we cannot afford to overlook this.

Watch your demonstrators and assistants and see that the work they turn out is satisfactory to you. Do this not only for the good of the school, but in common justice to the student.

DR. J. BRANSTON WILLMOTT, Toronto, Can.:

MR. PRESIDENT AND GENTLEMEN:

Considering the comprehensive character of the program prepared for the present meeting of the Institute, any lengthy paper on the subject assigned me would be out of place. A "symposium" on so practical a subject as the "Management of Teaching by Demonstrators in Infirmary," prepared by four persons engaged in teaching the same subject, must necessarily, in its detail, involve considerable repetition. In my brief contribution I will confine myself to the "general" rather than to the "detail."

The teaching of practical dentistry in the infirmary, to be effective must be preceded by a large amount of previous training. Dentistry is a *science* and an *art*. The *art* of dentistry is probably best acquired in a well organized infirmary under the direction of competent demonstrators. The *science* of dentistry is acquired in the lecture room and the laboratory. Just as the surveyor and the engineer first master the science of mathematics and then work the science out in the laying out of a railway line or the building of a bridge, so the dentist should first master the scientific aspect of dentistry before he is ready for a successful training in the art of dentistry.

This science of dentistry should include dental embryology, dental histology, dental pathology, including all the common pathological conditions incident to the dental organs; dental hygiene, dental therapeutics, macroscopic and microscopic anatomy of the teeth, dental chemistry, dental metallurgy. He should be familiar with the scientific treatment of caries, the preparation of cavities, the preparation of filling materials and the insertion and finishing of fillings. In addition he should have had such systematic digital training as shall educate his eye and hand to the easy and proper use of instruments.

Having fairly mastered these preliminaries the student of dentistry may now, but not before, intelligently enter upon the study and practice of the *art* of dentistry on the living subject in the infirmary.

The equipment of the infirmary is not now under consideration. but in passing, we may observe that in the matter of fixed equipment, such as light, chairs, cabinets, wash basins, etc., it should be liberally supplied. Each student should be compelled to furnish himself with everything necessary for all the usual operations. It is very desirable for many reasons, especially for convenience of demonstration, that in any given school this equipment should be practically uniform.

If the professor of operative and prosthetic dentistry could do his own demonstrating we would have an ideal condition. With large classes this is not possible. The duty must be devolved upon a corps of demonstrators. In the appointment of these great care should be exercised, that they are of good character and standing so as to command the respect of the students. They should be thoroughly familiar with the methods of the head of the department and entirely in accord with them.

They should be loyal to the teaching of the staff and to the school in which they are employed. The number required will vary from one to each eight or ten students, to one for each fifteen, or even more, students, engaged in operating for patients, depending on the experience of those over whom he is placed. In a school of, say, sixty seniors, with sixty chairs, and seven demonstrators in the infirmary, one would be given charge of the examination and extracting rooms, one the impression and prosthetic room and the prosthetic work, one the crown and bridge room, one the orthodontia department, the remaining three would supervise the operations for filling teeth. One of these latter would assign the patients, exercising judgment to select an operator whose skill was equal to the requirement of the patient. As their special duties permit, all demonstrators assist the students in any department of the infirmary.

A natural order of "evolution" in operative practical work by the student would be, first the examination of the mouth, noting the operations required, proceed to simple cavities to be filled with plastics, then treatment of pulpless teeth, then more difficult cases of plastic fillings and simple cavities with gold, then restoration of difficult cases with gold, then the use of porcelain fillings, and lastly when skill in the use of instruments has been well developed, the thorough removal of all deposits on the crowns, necks and roots of teeth, and the treatment of pathological conditions of the pericemental membrane.

Where previous private pupilage is not compulsory, most students enter the infirmary entirely ignorant of a great deal that will be immediately required of them. Many of them have never even seen a filling inserted for a patient. To assign a patient to such a student is inexcusable cruelty to the patient. Such students should first be appointed as assistants to experienced senior students. They could expedite operations by preparing the amalgam, mixing the cement, annealing the gold and placing it in the cavity with pliers.

etc. A week or two of experience in thus "fagging" for a senior and watching him operate would be of the greatest advantage to them when in the near future they are called upon to undertake a patient on their own account.

When a student without personal experience comes into the infirmary the demonstrator should aid him in his manipulations and in most cases perform the operation, or part of it, for him. He should have him under very close observation lest he go astray and injure his patient. As he acquires confidence and skill he should be taught to depend on himself. Too much assistance on the part of the demonstrator is a great evil. The student who depends upon, and gets, the assistance of the demonstrator to help him out of every little difficulty, will not develop the resourcefulness which is essential to success as an operator, and when left to himself will fail. It is of the greatest importance to the student of dentistry that he get, as early as possible in his course, a clear cut mental conception of what a successful operation should be when completed. This he gets partly from didactic teaching and partly from observing good demonstrations. When he has added to this a knowledge of the requisite manipulations, even though this knowledge may be largely theoretical, all that he requires to become expert is practice. When he has reached this stage of development the demonstrator should only interfere when it is necessary to protect the patient. He will learn infinitely more by meeting and mastering the numerous difficulties which will beset him than by merely watching the expert demonstrator deftly remove them for him.

No student should be permitted to "skimp" any work or operation. Everyone who has had any experience in infirmary work knows how great a tendency there is among a certain class of careless and indifferent students to do this. As a check upon it, no patient, for whom any work has been done, should be permitted to leave the infirmary until this has been inspected by a member of the staff. The knowledge that this inspection cannot be avoided will be a powerful deterrent to careless and slovenly operating. While it will be conceded that the primary object of the Dental Infirmary is the instruction of the student in the "Art of Dentistry" the patient is a very important factor in the instruction, and should be very carefully protected, by the demonstrators, from the malpractice of careless or ignorant students; this is all the more incumbent on the officers of a school from the fact that most of the patients are not there from choice but because they lack the pecuniary ability to go elsewhere for their dental treatment.

Dr. W. P. Dickinson, Minneapolis, Minn.:

The title given for the subject under discussion does not make it perfectly clear what our executive committee had in mind when it was proposed.

The term "management" might be construed to imply difficulty of controlling or directing, or it might imply simply the act of superintending or conducting. My thought is not to quibble over the term, but to indicate a slight embarrassment regarding a point of view.

That demonstrators are a necessary adjunct to most of the chairs, is a fact not necessary to enlarge upon; as to their duties or the character of their work, and their relation to the chairs, under which they serve, something may be said.

From the college announcements it may be readily seen that the corps of demonstrators are not very permanent bodies; that is, that changes are much more frequent than in the list of professors and instructors. It is a question of serious import to the conscientious executive and faculty oftentimes, as to where capable assistants may be found to carry out the teaching of the heads of the departments. In a large degree it may be said that teachers, like poets, are born, not made, and the discerning professor is ever on the keen lookout for developing talent that may later be utilized in his particular branch.

The policy of employing graduates, just out of school, for two or three half days each week, for a pittance and encouragement that connection with the school will be of enough more pecuniary advantage for remuneration, is to my mind a grave mistake. This leads me to say that when a student evinces special aptitude or capability for imparting knowledge to his fellows, this faculty should be encouraged and developed under careful direction of the chair, with the view of ultimately commanding his entire time, with salary commensurate with the value of the services rendered.

The developing of latent talent must be governed by circumstances; it may be permissible in individual cases to employ an undergraduate to assist in demonstrating the technics of a previous session's work, for experience must be obtained and the manner of getting it is as well expressed as can be by the maxim of Commenius, "let those things that have to be done be learned by doing them," or by accommodation, the best way to learn teaching is to teach. All this implies of course that the learning to teach must be under competent guidance and supervision.

It will be taken for granted that the heads of the infirmary departments, as well as others, have been chosen for their known ability and capability of conducting the special work entrusted to their charge. I shall assume that the idea underlying the discussion of the subject in hand is, how to obtain the best results from the pedagogical standpoint. Given the two factors, competent heads of departments, and demonstrators of good capability (I use this word instead of "ability" advisedly) how shall the best ideals be reached? First, to my mind, the details of presenting any particular branch should be in the hands of the chair, and the assistants and demonstrators should be held responsible directly to that chair. In order that there shall be harmony or unity in the teaching, the chiefs of each department should have regular meetings with his subordinates and take up the work in a sequential manner, and go over the entire course, from the simplest element to the most complex operation that will be demanded of the student while in the college.

Possibly it might be inferred that a slavish compliance with the professor's ideas would be required; on the contrary, there should be no stifling or repressing of the individuality of any member of the corps, but the very fact of frequent conferences, particularly during the early part of each session, would benefit all, from the chief to the most inexperienced in the work.

From the foregoing it will be seen that the so-called "Clinical Instructor" is entirely eliminated, the contention being that the student should be thoroughly grounded in a course of study, carefully thought out and systematically arranged by the faculty, as a harmonious whole.

"Too many cooks spoil the broth," and there will be time and opportunity enough after leaving the college halls to observe the methods of others than the faculty and regular instructors.

Dr. Jules J. Sarrazin, New Orleans, La.:

At the out-set of any consideration of this subject two opposed contentions may arise. The first is that dental students might benefit by a diversity of methods being didactically discussed and practically illustrated. The second is that absolute uniformity in teachings should exist between didactic and practical work, for fear of confusing the student's mind, instead of supplying a sound scientific basis for him to evolve from. While the first contention may contain beneficial truth when applied to a post-graduate course for practitioners of a few years' experience, there is no doubt in the writer's mind that such a course would confuse the unexperienced student who could be wholesomely fed only with methods based on dental anatomy, histology and physics applied to cavity preparation and filling. Moreover, such a basis will permit no deviation from correct outline, resistance and retentive forms of cavities and fillings, nor from the accurate introduction and knuckling of filling materials: adaptation, edge strength, flow, contraction and expansion, all being included, so that no diversity in the correct application of general principles involved is possible.

The ideal means of assuring close adherence of practical illustration to didactic teaching would no doubt be a personal, constant, day after day supervision of the demonstrators' work by the professor. This is, I believe, not often possible. It is not so in the Crescent City, unfortunately. We have arrived at other means of obtaining harmony between word and deed, which, although not the writer's ideal, seem an acceptable substitute. Our professor of operative dentistry is also professor of dental anatomy and operative technics. This at once permits application of dental anatomy knowledge to operative procedures in the treatment and filling of root canals, in cavity shaping which will weaken neither the functional faces of teeth crowns nor lobes of formation not continuous with teeth roots (or will otherwise dictate their complete removal), and in the shaping of proximal faces and their knuckling at marginal ridges. It allows emphasizing the necessity of occlusal stress being placed on filling material itself where natural binding marginal ridges are gone. This combination of didactic branches also suggests the handling of operative dentistry as identical with operative technics, plus oral secretions and the means for their exclusion, plus the living tissues and micro-organisms, plus the pigmentation of dentine, and the nervous system of the patient.

An unusual condition is that our Dean is at the same time demonstrator of operative technics (with a capable assistant under him) and professor of clinical dentistry, with clinic demonstrators also under him. This arrangement has grown out of the fact that he and our professor of operative technics, operative dentistry and dental anatomy have found that their ideas in operative dentistry ran in similar grooves, and have accordingly reached a conclusion, at least convenient, that their grooves must be correct since scientific basing will not permit divergence in such matters. They have agreed on some details, such for instance that root canals had better be enlarged by drilling than be septically pumped by cleansers, and had better be filled with gutta percha made germicidal than with semi-solid paraffine, that any incisal angle or marginal ridge, which, after the preparation of a simple proximal cavity, might be approached closer than 3-32 of an inch by a morsal wall, should be removed, except in cases of non-functional bicuspids or molars, and provided that the patient would solemnly promise never to allow an antagonist to be inserted, as there must be exceptions to all rules. Under this same exception, *but in no other case*, is it permissible to form a proximo-occlusal cavity for metal with a V-shaped morsal opening, and with retentive grooves in the buccal and lingual walls reaching vertically in the morsal direction, this provided moreover that the natural adjacent occlusal grooves in the crown perfect. The two department heads have otherwise easily agreed that in all usual cases correct retentive proximo-occlusal filling form, to oppose any strain, requires step formation with the extremity of the morsal dovetail floor dipping pulpally, and with anchorages placed at bucco and linguo-gingivo-axial cavity angles only, and that matrices are absolutely indispensable to all properly made compound amalgam fillings, and nearly so to gold disto-occlusal ones. They have also agreed that step retention was indicated in incisors where an incisal angle was absent, in preference to a lingual horizontal auxiliary dovetail, which latter in its turn became preferable when an incisal angle could safely be preserved to avoid filing material display. They have agreed on occlusal anchorages for compound amalgam fillings being wider-necked and slightly deeper than those for gold, on cavo-surface angles of histologically inclining enamel walls being beveled for gold and not for amalgam, and on the proportion of cohesive bulk to non-cohesive gold placed at the cervical part of a compound cavity being *at least* two to one. In fact they have as much as possible made sure that the heads of the practical and didactic departments would both preach the same sermon.

This first step having been made it has been our custom to call joint meetings of operative technique and clinic demonstrators, and with both above mentioned heads present, to rehearse matters, laying down the lines of teaching so as to make them harmonious. Then follows putting theory into practice by one professor lecturing and clinicing and the other overseeing the work of technique and clinic demonstrators. This has been our method, based on the conclusion that didactic and practical teaching must be and cannot be otherwise than the same, if correct. There is, however, one subject on which my mind is ill at ease, because, in the absence of a solution of the question by general experience, I see a necessity for teaching two different methods. This is the retention of porcelain inlay incisal angle or mesio-morsal first bicuspid restorations. Scientific basis and experience have established beyond doubt that metal fillings of that class could be safely retained only by step formation. An iridio platinum pin, No. 23 or 24 B. & S. gauge hooked at a dovetail's extremity, and with a rounded head baked in the porcelain inlay, first cemented in the cavity and afterwards veneered over with cohesive gold, is ample to afford the necessary step retention, I believe, without weakening the porcelain on account of its small diameter and rounded head, provided it be judiciously placed. Lingual horizontal auxiliary dovetails will here be indicated instead of incisal steps and deep enough central groove occlusal anchorages in bicuspids. The preceding refers of course to crowns with live pulps, the others not presenting the same difficulties.

On the other hand, some porcelain inlay experts assert that a good cervical seat for the inlay, combined with the adhesiveness of cement (which should not be much over 1-1000 of an inch thick in the finished work except at and nearing the cavity floor), will satisfactorily withstand the average 200 pounds pressure of normal occlusion. Joiners expel all the glue possible between wood joints, but do not resort to that construction to resist force from a plane parallel with small glued surfaces. A mast is not made of truncated cones separately glued together under pressure, and a lead pencil opposes about two square inches of glued surface to a working point which hardly strains. Yet, it is confidently claimed that a short cement joint, lying in a plane parallel to that of the enormous force applied, will save the inlay, provided it be well seated cervically. For my selfish good and that of suffering humanity may this be true! For the present, however, a departure from the rule of monotheism in teaching might be made on this subject and our advanced students be given acquaintance with two opposed methods.

I close in the hope of having said only one useful word on a subject so vital.

GENERAL DISCUSSION.

DR. A. O. HUNT, Omaha, Neb.:

The question of the relation of the professor and his teaching to teaching methods in the infirmary is one of the vital questions of the dental school. There are so many difficulties that enter into this relation that are almost insurmountable that to make a satisfactory adjustment is a matter of the greatest difficulty. The things that the professors teach and the things that the demonstrators have to do are not always in the best relation to each other. This is not the fault of either one or the other, but the result of a number of conditions. Every teacher in didactics has trouble to impart the desired information to the student, and at the same time fix an idea in his mind of the very highest order. He may even go to extremes in teaching to accomplish this purpose. This is undoubtedly more nearly true in the department of operative dentistry, as the ideals and the conditions met with in the infirmary are not always ideal. The professor does not go over all the minute details that are essential to operative dentistry, hence the schools have adopted methods of technique that give the student a good working basis, the details to be filled in by the demonstrator during the performance of the practical work. In the lecture room, as well as in the technic room, conditions may be made, but in the infirmary these conditions are very much interfered with, or are not the same. The indifference of some students, the indifference of the patient, the lack of intellectuality in the patient, interferes with carrying out perfect instrumentation. One difficulty with some students is, they must be shown everything. They are not all disposed, if they have an operation in hand, to start from the beginning of the case and make a careful diagnosis to work out in their minds all the conditions that are present, and thus arrive at the best methods that they should pursue in getting ideal results, as they have been taught to do in the lecture room, the technique room, etc.

Now, no matter how efficient the demonstrator may be, he cannot entirely overcome conditions like these. He cannot always make the student think; he can make him do certain things by not giving him credits. To help to overcome this difficulty, I adopted a plan many years ago of crediting the work step by step as it progresses, hoping thereby to inculcate the habit of thinking and diagnosing, reaching results mentally first, and then practically. That is, mark him upon the diagnosis of a case as one step; the preparation of the cavity as another. The manipulation and preparation of the material to be used, each represents a mark for him. He cannot go beyond any one stage without having it examined, because his card is punched at each division so that any demonstrator knows what the last mark was given for. The result is it prevents the doing of serious harm and going beyond the point where teaching is essential and absolutely necessary.

There is another difficulty that presents itself, and that is the demonstrator himself. Many demonstrators have the ability to tell how things should be done better than they can show the student how to do it. Others have the ability to show the student how it is done better than they can tell how to do it. Demonstrators of either character are valuable, but these are conditions. We do not find in demonstrators any more than in persons in other walks of life and professions, that they possess all the good attributes and good qualities that are ideal in the teaching of dentistry. One man's ability runs in one direction a little stronger than in another. Schools that are fortunate to possess demonstrators who possess all these qualities and attributes are to be congratulated. Unfortunately that kind of a demonstrator is the one you cannot keep very long. Their individuality and ability naturally carry them out into the world doing for themselves; whereas everyone knows that college work offers but little compensation.

By a system of examining each step of the operation, the student is put on his mettle all the time, the best interests of the infirmary are being looked after and the patient is certain of getting the very best work. The credits are punched out of the ticket and are figured up so that the proper credit may be given for that particular operation. This method has proven itself as feasible and it comes very near being perfect.

DR. J. Q. BYRAM, Indianapolis, Ind.:

We have had five subjects from five deans. I will speak from the other side of the question. I do not believe all that Dr. Hunt has said, that you cannot make the student think in the infirmary, or rather that the student does not think there. If he does not think there, something is wrong; he should be taught to think while he is working on the case. I will admit that there is a tendency for him not to think, but if our demonstrators are trained so that they simply go and help the student when he does not actually need help, it is true that in a short time the student will not think. I believe that we can train students to think in the infirmary and in every department. If the student comes to me for assistance in the technic department, I tell him to reason out how the operation should be done, and if he cannot get it, then to come to me for assistance. I do the same thing in the infirmary. As an example, a student comes to me with a case of pulp treatment. He may be trying to remove the pulp, and even though I try to give our students a thorough course in dental anatomy, many of them forget that a lower molar has two roots and that the mesial root usually has two canals. He cannot find all the canals. I do not try to find the canals for him, but I refer him to his dental anatomy and tell him to do all he can without my help. If, after working a while he cannot find the canals, then I assist him. When I demonstrate in the infirmary I do not help the student by doing the work, but I try to help him to help himself.

As to the difficulty of securing good demonstrators: Every one will admit that it is exceedingly difficult to get good demonstrators (that is the reason I was "fired" from our infirmary). I think that one difficulty is that when we get a good man it is only a short time until he leaves us. The trouble is that the demonstrator gets a very small salary. He probably gives half of his time to the college and the remainder to his private practice. He is a young man beginning the practice of dentistry in the city, and if he is the right kind of a man, he begins to build up a practice after he has been with the college but a short time. He realizes more from his practice than from his college work, and as a result he stays with his practice. In most cases the college prefers to look for another man rather than pay him enough to justify him remaining with the school.

The trouble is that you do not pay these men the salaries which justify them staying with you. You cannot keep a good man unless you pay him enough. The cheap man is always unsatisfactory, and you do not want him. Pay your demonstrators well and you will always have good ones.

Dr. C. N. Johnson, Chicago:

I have just a few words to say on this very interesting subject. The management of the demonstrators in the infirmary is becoming to me more simple every year. There has never been any difficulty in having perfect harmony in my department. I have never experienced the slightest tendency to lack of loyalty on the part of any demonstrator in the institution with which I am connected. I want to pay that tribute to the demonstrators who have taught under me, and many have. One reason, probably more than any other, that is responsible for this harmony, is that for the most part the demonstrators in our college are graduates of our institution, and I leave the demonstrating to them.

I have, as the superintendent of the department, on the floor a man who is superior in ability, and he is absolutely loyal. He is there all the time and all matters in the infirmary are referred to him. He reports to me every week, and if there is the slightest discrepancy it is referred to me at once and it is rectified; not by me but by him on my advice. The reason I keep away from the infirmary is this: It used to be the case that when I went through the infirmary to see what the students were doing, that students would call me here and there to give my judgment on this or that case. Nine times out of ten the student was calling me to see whether he had received the proper instructions from the demonstrator. He had already appealed for assistance to the demonstrator and had received his instructions, but he also wanted my idea, and because of the fact that I was sometimes able to decide the question more rapidly or in a different way, it was demoralizing at once. It gave rise to the suspicion that the demonstrator was not entirely qualified. And I ask my students to show the same loyalty to my demonstrators that they show to me.

I want to cite just one instance that was instrumental in making me change my plan, and it is why I will not, unless requested by the demonstrator, go to a patient and demonstrate. One day, in the infirmary, a demonstrator had a case of a lower second molar. The first permanent molar was out; the rubber dam was on; the second molar was tipped slightly forward so that the student had considerable difficulty finding the root canals. He said that he had found the canal in the distal root, but could not find the one in the mesial root. He called the demonstrator, who tried but could not find the canal either. The demonstrator was called suddenly away from the chair and in his absence the student slipped around and called me without informing me that the demonstrator had seen it. I went, looked the case over, picked up a bur and exposed the distal canal. Both the demonstrator and the student had, on account of the tipping of the tooth, mistaken the mesial for the distal canal. It was the laugh of the whole college. It went around the infirmary like wild-fire and it interfered with the demonstrator's efficiency as a teacher in our college.

Demonstrating should be left in the hands of the demonstrator, and there should be absolute loyalty on the part of the demonstrator to the professor.

I want to express my opinion, as Dr. Byram has said, that Dr. Hunt is mistaken in regard to the fact that the demonstrator cannot make the student think in the infirmary. I use the expression that Dr. Hunt used, but I do not believe that he means that. The very thing above all others that the demonstrator is there for is to make the student think. The worst kind of demonstrating I know of is where the student calls the demonstrator to the chair and asks him what he is to do next, and the demonstrator picks up an instrument and does the work himself. That is not efficient demonstrating. I instruct my demonstrators something like this: You must not allow any student to do damage to the patient, but when the student comes and asks you what he is to do in that particular case, stop him and ask him, "What is your opinion as to what you had better do?" Make the student think the thing out himself and never give an opinion until the student has expressed himself on that particular point. This is not the way that these things were done years ago when we sent students out of our schools mere machines, without any judgment whatever. Their reasoning ability had never been developed. But now the student himself decides the matter, and then if there is a mistake in his reasoning he is corrected by the demonstrator before any harm has been done to the patient.

All along the line of teaching it is not merely a matter of pounding knowledge into the student, but of developing his reasoning faculties. There is no teaching more vicious than that which makes a mere machine of the student. He should be taught to think for himself; let him solve his own problem and you are doing him vastly more good than by continually showing him how to do it.

DR. GEO. W. DITTMAR, Chicago:

I have had a little experience as a demonstrator, and one question comes to my mind in this connection, and that is this: Would Dr. Johnson teach or instruct that student before the patient as regards to the proposition in hand? Would he have the student make the diagnosis there and probably outline his method of treatment, and then, perhaps, have it entirely wrong? If the demonstrator's opinion is at variance with that of the student, and if he gives expression to that opinion, may not the patient lose his confidence in the student?

Dr. Johnson:

It is impossible to escape consultation in this matter in the presence of the patient. Any demonstrator who has any tact at all, even if the student is entirely wrong, both in his diagnosis and the method of treatment, can correct that error by using only technical terms so that the patient will not be cognizant as to what is being said.

Dr. A. O. Hunt, Omaha, Neb.:

I certainly do not want a wrong impression to prevail as to what I said or meant. I was speaking of the conditions that exist in the infirmary, and one of the conditions I named was the tendency of some students not to think. Often they want to have something demonstrated, saying that they can understand it better if they see it done. On occasions that, perhaps, is the best thing and it may lead to better results, but some students do not like to study a thing out, work it out for themselves. That is what I want to be understood as having meant, and not that it is a general thing among students, but that it is too common.

As to whether you are going to debate a case in the presence of the patient: While I would not in any way, or for any reason, injure the feelings of a student in the presence of a patient, yet I believe that the best results will follow if you keep in the mind of the patient all the time, and in the mind of the student as well, that he is a student under instruction, and that he is not expected to know everything. The best results are obtained by keeping in the mind of all concerned the relation of things. You are instructing the patient at the same time as to the nature of the trouble and what had best be done to remedy it. I have always adhered to the belief that a successful practice is better maintained by having your patient know as much as possible about dentistry and in the infirmary you are instructing many people. I can see no harm in debating a question in the presence of the patient so long as it is done in the proper way without humiliating the student. Do it in a thoroughly scientific manner and only with reference to the particular case in hand.

Dr. G. V. Black, Chicago:

I have listened to this discussion with a great deal of pleasure. Such a discussion as this could not have been held five years ago. We as teachers did not have a sufficient amount of training in this work to have held such a discussion; one that is as broad in its bearing as the discussion we have had to-day. To me it means great progress in our work. Now a word or two as to some points in connection with the training of the student in the infirmary.

I like to have my demonstrators meet me every week and talk to them about what I am lecturing on to my class at that particular time, and have those particular things reinforced by the demonstrators in the clinic room following the presentation of the subject in the lecture room; not that they are not giving attention to those things all the time, day after day. But just at the time that the lecture is given and following that is one of the best times for the demonstrators to reinforce these things as they come up in the clinic room.

If I have given a lecture and demonstrations in the placing of the rubber dam, I would like every demonstrator to give that his special attention for the next week or so. And so on with everything I do in presenting subjects to the class. I think that this serves to reinforce the work of the lecture room very powerfully.

I appreciate very keenly the difficulty of obtaining a good corps of demonstrators, efficient men. The conditions under which we work make that unusually difficult; that is, unusual as compared with other things. But for the present we must get along with that difficulty the very best way we can.

The question of consultations before patients is, I think, rightly put by Dr. Hunt. We should not refuse to consult with students or student demonstrators before the patient. In fact, the more plainly we keep it before the public or the patients who come to us that this is a school; that the students are studying dentistry, that they are studying these operations, and that consultations are the thing, the better it is for all concerned. It is better for the student, better for the demonstrator, better for the patient that these things be done.

As for the patient: The patient should know that he is under guard all the time. The work must be examined; the student must have a written permit to operate on that patient; a written assignment, and that is his authority for undertaking any operation. You all know that the State Board of Dental Examiners does not allow persons to practice dentistry who have not passed the regular examination for license to practice. The student who goes to work on a patient without having this permit or assignment might be subject to arrest. From the time the patient enters the infirmary until he leaves both he and the student are under guard and under the care of the demonstrator or the professor, and the student does nothing without their sanction. That is a legal form and it is a form for the protection of the patient and for the instruction of the student, and every step of the work must be examined before it is passed and a record made of the whole. Next year, when it is asserted that such and such a thing was done in our school by such and such a student, even if the student is not known, we ought to be able to take it up and go through all those steps and know under whose eye this thing was done, how it was done, by whom, etc. Everything should be a matter of record so that we may know all about it.

So that this careful guarding of the patient's interests is also a careful guarding of the interests of the student, and if they do any one step of the operation that is not just right, they should be set right before they are allowed to go to the next.

DR. H. A. SMITH, Cincinnati, Ohio:

There is one thing that occurred to me while listening to this discussion as to the demonstrator. It is the announcing of a number of demonstrators by certain colleges who never appear as teachers. In fact, it has been known that demonstrators are advertised who have been dead for years. Is not this done with the view of taking an unfair advantage of colleges that are more honest in their methods and only announce the names of men who appear and serve as they are expected to by the student?

With reference to the professor being on the floor of the clinic room: I think it is possible for the professor to be on the floor too much. The students seem to lose their respect for a man who is always prowling around. When he does appear on the floor let there be a reason for it. I suggested that some years ago to the late Dr. Menges, who, as you know, had his office right on the infirmary floor, and he said, "By George, I never thought of that."

In regard to consultation with reference to a certain case in hand: You all know that the student is very sly and will come to you whether he really wants an opinion or not, hoping to get a different opinion from that which the demonstrator has given for the purpose of making mischief, and if you are not very careful you are liable to be caught in the trap. How can you avoid that? By approaching the case modestly, as any consultant ought; the conference should be conducted somewhat on the lines of a true medical consultation. Respect the doctor who has been there before you; find out, if possible, what his opinion is. Do not take a decided position until you have had a full and free conference with the demonstrator in charge of the case.

Dr. N. S. Hoff, Ann Arbor, Mich.:

This matter of abuse of a patient to which Dr. Smith referred reminds me that oftentimes patients are abused in our clinics by being disappointed in regard to their work. Students will not keep their appointment with their patients. Opportunity also occurs for abuse in connection with the crown and bridge or prosthetic work, by unnecessary delays in completing the work, or by unintentional and sometimes by intentional slights in construction. I would like to have some of our wise clinical managers tell us how they manage to keep the student in line and make them keep their appointments and not abuse the confidence of the patient.

Dr. J. Q. Byram, Indianapolis:

We have a scheme at our school that remedies the matter to which Dr. Hoff refers. We work by the point system. We have an engagement book and engagement blanks. The student makes an engagement and gives the patient a duplicate. The clerk records all engagements in the book, and if the student forgets the engagement he can refer to the book. If he failed to make a written engagement with the patient, he is held responsible; and if the patient comes and he is absent we charge him with a broken engagement. If he has a written engagement and fails to keep it he is also charged with a broken engagement. We deduct fifteen points for each broken engagement. At the end of the year these points are deducted from his total credits.

Dr. H. L. Banzhaf, Milwaukee, Wis.:

I would like to have Dr. Berry tell you what we do in our school in Milwaukee in answer to Dr. Hoff's question.

Dr. F. H. Berry, Milwaukee, Wis.:

I do not know that I can shed much light on that subject except that in my case a good deal depends, perhaps, on my own individuality by keeping a tab on the thing myself. I know what appointments the students make; I know when work ought to be ready for the patient; I try to keep in touch with the patient and know when they are coming and by keeping the different things in mind in this way we manage to get along very well.

Then I keep a sort of point record which counts either for or against the student and at the end of the year I check them up either to their credit or discredit, as the case may be. I think by letting the students know that you are keeping this record, no matter whether it is correct or not, it serves both as a check and a spur. It has an influence in keeping them busy and interested in their work. Of course, a good deal depends on the control the man at the head of the infirmary has over his students. Whatever you may devise to make them do just what they are expected to do, will be a success only in proportion to the way it is enforced.

Dr. H. L. Banzhaf, Milwaukee, Wis.:

Dr. Berry is too bashful to tell you just what he does to control his students. Dr. Hoff wanted to know what the wise ones do to control the students, especially in regard to keeping their appointments. Dr. Berry has a little box nailed at the end of the infirmary and in this are placed the names of all the students who work in the infirmary. The box contains a number of brass bars on which the doctor has printed the name of the student. As a case comes in the bar at the bottom is taken out and the student whose name is on this has the case assigned to him. Then this bar is put into a drawer. Each day, in the morning, the demonstrator looks into this drawer to see just where the student is and what he is doing. If he is not in the laboratory he immediately finds out what he is doing, and why he is not in the infirmary. In that way we keep close tab on our students.

Dr. Berry:

I did not mention this part of it because I do not call that teaching methods. It has its good effect so far as the school is concerned in getting the work out on time, but it teaches the student to be punctual in a machine way. It is not just the best method.

Dr. W. E. Grant, Louisville, Ky.:

Teaching methods in the infirmary. This subject is so broad and so important that we ought to devote a whole day to its discussion instead of only a few hours. As to the matter of teaching the student to keep his engagements. It is important to have a time limit during which the student is allowed to meet his patient, and that limit ought not to exceed fifteen minutes. That is to say, if a student has an engagement at two, and he is not there at fifteen minutes after two, the engagement is considered as being broken and the case is turned over to another student. The erring student should also be punished by giving him more work or by taking off so many points from his credits. (If you use the point system, which I heartily recommend, not only in the operative department, but in all departments, the student is graded on the point basis.) Of course, it has its disadvantages as well as its advantages.

It is not fair to the patient to turn him over to a student who is not competent to do the work. The student should, if possible, begin on simple gold fillings and simple work of all kinds. He must work gold to learn to work gold, etc., for that is the only way in which that student will ever learn, and, furthermore, the work is being done under the supervision of a corps of demonstrators so that no harm will be done the patient.

Dr. Guilford:

That is the plan exactly that we pursue in our school. The student is allowed fifteen minutes. If he does not appear then the case is assigned to another student.

DR. PATTERSON:

I would like to know how the student, who is unable to perform a certain difficult operation, is going to be taught to do this work if all such cases are referred to those students whose ability is unquestioned. It appears to me that this method is very unfair and partial.

DR. J. Q. BYRAM, Indianapolis:

I have adopted a scheme this year which I believe will answer Dr. Patterson's question. It is a co-operation of the technic and the infirmary. As I stated a moment ago, we use the point system. I give the student points on all technic work; these points have a certain value in the infirmary. As an example: we give seven points for each practical shell crown and four points for each shell crown made in the technic laboratory. Our requirements in Junior crown and bridge work before the holidays were two molars and a bicuspid. Some Juniors have made as many as twenty technic crowns. If they are not busy in the infirmary this system encourages them to keep busy. They go to the technic laboratory in the afternoon, and if a student is wanted in the infirmary the demonstrator sends for him. The busy students are learning something.

I am also using this system in the plate work and when we have a four years' course I propose to inaugurate it in the operative tehnic department. My idea is to keep the boys busy from the time they enter school until they leave. We know that students feel that they do too much technic work; they do not see the result. By encouraging the student to do this work, and by giving him these credits, he will work, and he works in a different way, because he is anxious to have a large number of points. The poor student must work or he gets behind.

DR. PATTERSON:

I allow that the technic work is exacted from them all, but it is a common practice that a certain operation is given to a certain student because he is most competent to do it. That is common practice, but it is a wrong practice. The man who can perform the operation does not need the practice as does the man who is not able to perform that particular work. I do not understand why the best operators should do all the work that is difficult of performance. They do not need it, while the others do. It is a pernicious practice, one which should not be encouraged.

Dr. Byram:

Out of a class of sixty students there are about twenty who stand above the others. There are at least ten who are far below the other fifty. About half of the class can be placed on a level. Let us take the ten students who are not proficient, and if we give one of them a difficult operation, what is the result? In most cases the result is far from being satisfactory to the patient, student or the demonstrator. Even though we require the student to do the work over, in most cases the patient becomes dissatisfied and goes elsewhere. Patients who come to our infirmaries have other things to do besides having dental operations performed.

By requiring the poor student to work on his technic, and to do more technic than the better ones, and by giving him his points, it encourages him, and brings him up to a certain mechanical standard which will enable him to do the operation successfully.

Another point: theoretically all students should be on a level in the infirmary, but practically this is bad.

We have many patients come to the infirmary because they feel that their work will be well done. If we give these patients to inferior students we drive them away and decrease the clinic. We must build up the clinic by giving a difficult operation to the best student. He is better than the other because he is naturally more proficient. The poor student must be brought up step by step; the simpler operations first, then, finally, give him difficult work. In my opinion it is not justice to student or demonstrator to give difficult operations to the poor student until he becomes proficient.

Dr. W. E. Grant, Louisville, Ky.:

I hope that Dr. Patterson has been answered. I want to bring out this point--that dividing the class as Dr. Byram has divided it, you do ten poor students an injustice. If you pile on work that they cannot do you discourage them, and, as Dr. Byram says, you must take care of your clinic. These patients expect to get good work and they ought to get it. You cannot do as you please with them. You must build up the infirmary practice as you would build up your own practice. You must take care of it; you must nurse it, and here efficient demonstrators will help the good work along. The point is this: If a six or eight tooth bridge comes in, and that poor student is not competent to make a shell crown, how much harm you are doing him by assigning that case to him. Put him back on his technique.

DR. PATTERSON:

What is the purpose of the dental infirmary and dental teaching? Is it to build up an infirmary practice or to make dentists?

DR. GRANT:

Unless you have an infirmary you cannot make dentists, and for that reason you must nurse this practice if you are going to make dentists out of the best part of your class. You must not injure ninety per cent of your class in order to develop those ten poor students. Let that man go back and give him an infirmary case in which he can put on a shell crown, and put on a two-tooth bridge instead of a six or eight, which he is not competent to handle.

DR. G. V. BLACK, Chicago:

The infirmary patient generally is the patient of that particular student; at least, that is the case in our infirmary. They come for the purpose of having a particular student perform some operation upon them, just as our patients come to us in our private practice. Now, I do not want to give that patient over to some other student. I will punish that student for failing to keep his appointment in some other way. I want every student in my infirmary to be building up a practice of his own, gathering his patients around him. That is his business just as it is his business to perform the operations properly. And if it so happens that the case which is assigned to a student is too much for him, somebody must assist him. What is the demonstrator there for? Somebody must assist the student and see that the patient is properly dealt with. It is impossible for us to parcel out the assignments in exact accordance with the ability of the student. We cannot do that; we must watch over and assist those cases that fall into the hands of students who are incapable. In that way we will also guard our infirmary practice, at the same time teaching the student who is incapable.

APPENDIX — A.

LIST OF MEMBERSHIP COLLEGES WITH DULY ACCREDITED REPRESENTATIVES PRESENT, DUES PAID AND ENTITLED TO VOTE.

Northwestern University, Dental Department.
College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Royal College of Dental Surgeons.
Dental Department, Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
University of Iowa College of Dentistry.
Indiana Dental College.
Kansas City Dental College.
University of Buffalo, Dental Department.
Dental Department, University of Pennsylvania.
Philadelphia Dental College.
Department of Dentistry, Detroit College of Medicine.
Dental Department, Ohio Medical University.
Missouri Dental College.
Dental Department, University of Omaha.
Pittsburg Dental College.
New York College of Dentistry.
College of Dentistry, University of Illinois.
Dental Department, Medico-Chirurgical College, Philadelphia.
New Orleans College of Dentistry.
Keokuk Dental College.
Cincinnati College of Dental Surgery.
Birmingham Dental College.
Baltimore College of Dental Surgery.
Marion Sims Dental College.
Dental Department, Milwaukee Medical College.

MEMBERSHIP COLLEGES WITHOUT ACCREDITED DELEGATES.

Dental Department, University of California.
Dental Department, University of Tennessee.
Pennsylvania College of Dental Surgery.
Southern Dental College.
Atlanta Dental College.
Washington Dental College.
Total membership, 36.
Colleges represented by delegates, 30.
Colleges without delegates, 6.
Colleges admitted at this meeting, 1.

Respectfully submitted,
H. B. TILESTON,
Secretary and Treasurer.

APPENDIX—B.

Those in Attendance.

H. J. Goslee, Chicago.
L. C. Borland, Chicago.
A. H. Peck, Chicago.
J. R. Watt, Chicago.
R. C. Brophy, Chicago.
R. R. Maldson, Chicago.
C. N. Johnson, Chicago.
J. P. Buckley, Chicago.
C. E. Jones, Chicago.
F. C. Zapffe, Chicago.
B. J. Cigrand, Chicago.
F. W. Parker, Chicago.

T. W. Brophy, Chicago.
G. V. Black, Chicago.
J. D. McCauley, Chicago.
E. Noyes, Chicago.
F. B. Noyes, Chicago
J. G. Reid, Chicago.
D. M. Cattell, Chicago.
G. W. Dittmar, Chicago.
J. H. Prothero, Chicago.
G. W. Cook, Chicago.
R. W. Parker, Chicago.

J. D. Patterson, Kansas City, Mo.
H. B. Tileston, Louisville, Ky.
W. E. Grant, Louisville, Ky.
N. T. Yager, Louisville, Ky.
E. M. Keltey, Louisville, Ky.
F. L. Whitman, Louisville, Ky.
W. E. Willmott, Toronto, Ontario.
W. C. Trotter, Toronto, Ontario.
A. W. Thornton, Toronto, Ontario.
A. O. Hunt, Omaha, Neb.
F. R. Ross, Omaha, Neb.
M. C. Marshall, St. Louis, Mo.
J. H. Kennerly, St. Louis, Mo.
W. M. Bartlett, St. Louis, Mo.
H. Prinz, St. Louis, Mo.
D. Lindsley, St. Louis, Mo.
B. E. Fischer, St. Louis, Mo.
R. H. Nones, Philadelphia, Pa.
S. H. Guilford, Philadelphia, Pa.
C. R. Turner, Philadelphia, Pa.
Edwin T. Darby, Philadelphia, Pa.

H. L. Ambler, Cleveland, Ohio.
G. H. Wilson, Cleveland, Ohio.
H. C. Kenyon, Cleveland, Ohio.
W. H. Whitslar, Cleveland, Ohio.
F. C. Manchester, Cleveland, Ohio.
W. A. Price, Cleveland, Ohio.
C. V. Vignes, New Orleans, La.
H. B. Gessner, New Orleans, La.
W. C. Barrett, Buffalo, N. Y.
J. A. Sherwood, Buffalo, N. Y
W. P. Dickinson, Minneapolis, Minn.
O. A. Weiss, Minneapolis, Minn.
T. B. Hartzell, Minneapolis, Minn.
A. Owre, Minneapolis, Minn.
E. F. Hartz, Minneapolis, Minn.
J. O. Wells, Minneapolis, Minn.
J. M. Walls, Minneapolis, Minn.
G. J. Dennis, Minneapolis, Minn.
T. E. Weeks, Minneapolis, Minn.
W. B. Fulton, Birmingham, Ala.
E. Hillyer, New York, N. Y.
F. D. Weisse, New York, N. Y.
H. W. Arthur, Pittsburg, Pa.
D. R. Stubblefield, Nashville, Tenn.
H. P. Neeper, Keokuk, Iowa.
G. S. Shattuck, Detroit, Mich.
W. T. McLean, Cincinnati, Ohio.
H. A. Smith, Cincinnati, Ohio.
F. H. Berry, Milwaukee, Wis.
P. B. Wright, Milwaukee, Wis.
F. J. Wilson, Milwaukee, Wis.
H. L. Banshaf, Milwaukee, Wis.
W. G. Foster, Baltimore, Md.
J. Q. Byram, Indianapolis, Ind.
G. E. Hunt, Indianapolis, Ind.
L. P. Bethel, Kent, Ohio.
C. A. Hawley, Columbus, Ohio.
L. E. Custer, Dayton, Ohio.

W. S. Hosford, Iowa City, Iowa.
F. T. Breene, Iowa City, Iowa.
N. S. Hoff, Ann Arbor, Mich.
L. P. Hall, Ann Arbor, Mich.
C. P. Shaw, Boston, Mass.